# *INSTALLATION MANUAL*

# *FOR SEA TEL 4009-91 BROADBAND-AT-SEA*

# *TRANSMIT / RECEIVE SYSTEM WITH SELECTABLE CO-POL OR CROSS-POL RECEIVE*

| | | |
|---|---|---|
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***Sea Tel Inc is also doing business as Cobham Antenna Systems***



**July 20, 2012** **Document. No. 132861 Revision D**

**These commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.**

**Sea Tel Marine Stabilized Antenna systems are manufactured in the United States of America.**

Sea Tel is an ISO 9001:2008 registered company.

Certificate Number 13690 issued March 14, 2011.

**R&TTE**

**CE**

The Series 09 Family of Marine Stabilized Antenna Pedestals with DAC-2202 or DAC-2302 Antenna Control Unit complies with the requirements of directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on Radio equipment and Telecommunication Terminal Equipment. A copy of the R&TTE Declaration of Conformity for this equipment is contained in this manual.

The Sea Tel Series 09 & 10 antennas will meet the off-axis EIRP spectral density envelope set forth in FCC 47 C.F.R. § 25.222(a)(1) when the input power density limitations, listed in our FCC Declaration, are met..

These antenna systems also contain FCC compliant supervisory software to continuously monitor the pedestal pointing accuracy and use it to control the "Transmit Mute" function of the satellite modem to satisfy the provisions of FCC 47 C.F.R. § 25.222(a)(l)(iii).

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**Revision History**

| REV | ECO# | Date | Description | By |
|---|---|---|---|---|
| A | N/A | November 5, 2010 | Production Release | MDN |
| B | N/A | April 21, 2011 | Removed Diagnostic Software AND Setup - CommIF Chapter ,added Functional Testing AND Stowing the Antenna chapters, update PCU configuration and drawings. | MDN |
| C | N/A | May 24, 2012 | Added Green Passport and Installation Troubleshooting procedures. Expanded installation and modem chapters , Updated drawings. | MDN |
| D | 9100 | July 20, 2012 | Added Bluetooth chapter and updated all text. | MDN |
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# Declaration of Potentially Hazardous Materials onboard for the Green Passport Requirement

(Based on Annex 2 to the Industry Code of Practice on Ship Recycling, August 2001.*)

This inventory is part of the ship's Green Passport and provides information with regard to materials known to be potentially hazardous and utilized in the construction of the ship, its equipment and systems. It may be supplemented, as appropriate, with technical information in respect of certain categories of potentially hazardous materials listed in this document, particularly with regard to their proper removal and handling.

The Equipments Maker / Supplier have to declare if his equipment / equipments contain any of the hazardous material listed below with concentration and duly signed and stamped.

## Vessel Name/Hull Number/Shipyard:

## Equipment Details: All Sea Tel manufactured antenna systems.

## Supplier Details:

Sea Tel, Inc
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Concord, CA. 94520
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### PART 1 – POTENTIALLY HAZARDOUS MATERIALS IN THE SHIP STRUCTURE AND EQUIPMENT

#### 1A. ASBESTOS

| Type of Asbestos Materials in System/Equipment/Component | Approximate quantity/volume |
|---|---|
| N/A | 0 |

#### 1B. Paint with – Additives (Lead, Tin, Cadmium, Organotins (TBTs), Arsenic, Zinc, Chromium, Strontium, Other)

| Type of Additives | Materials containing additives | Location (If Applicable) | Approximate Quantity |
|---|---|---|---|
| N/A | N/A | N/A | 0 |

#### 1C.Plastic Materials

| Type | Components containing plastic materials | Location (If Applicable) | Approximate quantity/volume |
|---|---|---|---|
| N/A | N/A | N/A | 0 |

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**1D. Materials containing PCBs, PCTs, PBBs at levels of 50mg/kg or more**

| Type PCBs/PCTs/PBBs | Components containing such materials | Location (If Applicable) | Approximate quantity/volume |
|---|---|---|---|
| **N/A** | **N/A** | **N/A** | **0** |

**1E. Gases sealed in the equipment or machinery of supplied system**

| Type | Equipment/Component containing such gases | Location (If Applicable) | Approximate quantity/volume |
|---|---|---|---|
| Refrigerants (R12/R22) | N/A | N/A | **0** |
| HALON | N/A | N/A | **0** |
| $CO^2$ | N/A | N/A | **0** |
| Acetylene | N/A | N/A | **0** |
| Propane | N/A | N/A | **0** |
| Butane | N/A | N/A | **0** |
| Oxygen | N/A | N/A | **0** |
| Other (Specify) | N/A | N/A | **0** |

**1F. Chemicals in the equipment or machinery of supplied system**

| Type of chemicals | Equipment/Component containing such chemicals | Location (If Applicable) | Approximate quantity/volume |
|---|---|---|---|
| Anti-seize Compounds | N/A | N/A | **0** |
| Engine Additives | N/A | N/A | **0** |
| Antifreeze Fluids | N/A | N/A | **0** |
| Kerosene | N/A | N/A | **0** |
| White Spirit | N/A | N/A | **0** |
| Boiler/Water Treatment | N/A | N/A | **0** |
| De-ioniser Regenerating | N/A | N/A | **0** |
| Evaporator Dosing and | N/A | N/A | **0** |
| Descaling Acids | N/A | N/A | **0** |
| Paint/Rust Stabilisers | N/A | N/A | **0** |
| Solvents/Thinners | N/A | N/A | **0** |
| Chemical Refrigerants | N/A | N/A | **0** |
| Battery Electrolyte | N/A | N/A | **0** |
| Hotel Service Cleaners | N/A | N/A | **0** |
| Other (Specify) | N/A | N/A | **0** |

**1G. Other Substances inherent in the machinery, equipment or fittings of supplied system**

| Type | Equipments/Components contain such materials | Location (If Applicable) | Approximate quantity/volume |
|---|---|---|---|
| Lubricating Oil | N/A | N/A | **0** |
| Hydraulic Oil | N/A | N/A | **0** |
| Lead Acid Batteries | N/A | N/A | **0** |
| Alcohol | N/A | N/A | **0** |
| Methylated Spirits | N/A | N/A | **0** |
| Epoxy Resins | N/A | N/A | **0** |
| Mercury | N/A | N/A | **0** |
| Radioactive Materials | N/A | N/A | **0** |
| Other (Specify) | N/A | N/A | **0** |

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All of the plastics used on Sea Tel antenna systems are completely inert and pose no harm when in use or when scrapped.

All of the lubricating oils used on Sea Tel antenna systems are completely inert and pose no harm when in use or when scrapped.

All of the anti seize compounds used on Sea Tel antenna systems are completely inert and pose no harm when in use or when scrapped.

We hereby declare that the above inventory of potentially hazardous material truly correspond to the equipment / equipments supplied to ship.

_____ Oct 06, 2011

John Phillips Date
VP Engineering
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**Cobham plc** is an international company engaged in the development, delivery and support of advanced aerospace and defence systems for land, sea and air platforms. The company has five technology divisions and one in the service sector that collectively specialise in the provision of components, sub-systems and services that keep people safe, improve communications and enhance the performance of aerospace and defence platforms.

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# R&TTE Declaration of Conformity

Doc Number 130411 Revision C

**Sea Tel Inc.** declares under our sole responsibility that the products identified below are in compliance with the requirements of:

DIRECTIVE 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on Radio equipment and Telecommunication Terminal Equipment and the mutual recognition of their conformity.

Product Names:

**4009 Ku Band Tx/Rx Maritime Satellite Earth Station**
**5009 Ku Band Tx/Rx Maritime Satellite Earth Station**
**6009 Ku Band Tx/Rx Maritime Satellite Earth Station**
**4010 Ku Band Tx/Rx Maritime Satellite Earth Station**
**5010 Ku Band Tx/Rx Maritime Satellite Earth Station**
**3011 Ku Band Tx/Rx Maritime Satellite Earth Station**

These products have been assessed to Conformity Procedures, Annex IV, of the above Directive by application of the following standards:

**EMC:**

| | |
|---|---|
| EMC standard for Radio Equipment (Maritime) | **ETSI EN 301 843-1 V1.4.1 (2004-06)** |
| EMC standard for Radio Equipment (Common) | **ETSI EN 301 489-1 V1.4.1 (2002-08)** |
| EMC standard for Radio Equipment (General) | **ETSI EN 300 339 (1998-03)** |
| Marine Navigational and Radio Communication Equipment and Systems – General Requirements: | **IEC EN 60945:1997** |

**Satellite Earth Stations and System (SES):**

| | |
|---|---|
| Harmonized EN for Very Small Aperture Terminals (VSAT): | **ETSI EN 301 428-1 V1.3.1 (2006-02)** |
| Harmonized EN for satellite Earth Stations on board Vessels (ESVs) | **ETSI EN 302 340 V1.1.1 (2006-04)** |

**Safety:**

| | |
|---|---|
| Safety of Information Technology Equipment: | **IEC EN 60950-1:2001 (1st Edition)** |

Certificates of Assessment were completed by and are on file at NEMKO USA Inc, San Diego, CA

Sea Tel, Inc
Concord, CA

1/24/2012

Peter Blaney, Chief Engineer Date

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# FCC Declaration of Conformity

1. Sea Tel, Inc. designs, develops, manufactures and services marine stabilized antenna systems for satellite communication at sea. These products are in turn used by our customers as part of their Ku-band Earth Station on Vessels (ESV) networks.

2. FCC regulation 47 C.F.R. § 25.222 defines the provisions for blanket licensing of ESV antennas operating in the Ku Band. This declaration covers the requirements for meeting § 25.222 (a)(1) by the demonstrations outlined in paragraphs (b)(1)(i) and (b)(1)(iii). The requirements for meeting § 25.222 (a)(3)-(a)(7) are left to the applicant. The paragraph numbers in this declaration refer to the 2009 version of FCC 47 C.F.R. § 25.222.

3. Sea Tel hereby declares that the antennas listed below will meet the off-axis EIRP spectral density requirements of § 25.222 (a)(1)(i) with an N value of 1, when the following Input Power spectral density limitations are met:

| | |
|---|---|
| *0.6 Meter Ku Band, Models 2406 and USAT-24 are limited to | -21.6 dBW/4kHz |
| *0.75 Meter Ku Band, Models 3011 and USAT-30 are limited to | -21.6 dBW/4kHz |
| 1.0 Meter Ku Band, Models 4003/4006/4009/4010 are limited to | -16.3 dBW/4kHz |
| 1.0 Meter Ku Band Model 4012 is limited to | -16.6 dBW/4kHz |
| 1.2 Meter Ku Band, Models 4996/5009/5010 are limited to | -14.0 dBW/4kHz |
| 1.5 Meter Ku Band, Models 6006/6009 are limited to | -14.0 dBW/4kHz |
| 2.4 Meter Ku Band, Models 9797 and 9711QOR are limited to | -14.0 dBW/4kHz |

4. Sea Tel hereby declares that the antennas referenced in paragraph 3 above, will maintain a stabilization pointing accuracy of better than 0.2 degrees under specified ship motion conditions, thus meeting the requirements of § 25.222 (a)(1)(ii)(A). Those antennas marked with * will maintain a stabilization pointing accuracy of better than 0.3 degrees. The Input Power spectral density limits for these antenna have been adjusted to meet the requirements of§ 25.222 (a)(1)(ii)(B).

5. Sea Tel hereby declares that the antennas referenced in paragraph 3 above, will automatically cease transmission within 100 milliseconds if the pointing error should exceed 0.5 degrees and will not resume transmission until the error drops below 0.2 degrees, thus meeting the requirements of § 25.222 (a)(1)(iii).

6. Sea Tel maintains all relevant test data, which is available upon request, to verify these declarations.

Peter Blaney, Chief Engineer
Sea Tel, Inc
Concord, CA

**1. 09 SERIES SYSTEM CONFIGURATION(S) ..... 1-1**

1.1. SERIES 09 BASIC SYSTEM INFORMATION ..... 1-1

1.2. SYSTEM CABLES ..... 1-1

1.3. OTHER INPUTS TO THE SYSTEM ..... 1-1

1.4. SIMPLIFIED BLOCK DIAGRAM OF A SERIES 09 SYSTEM ..... 1-1

1.5. DUAL ANTENNA CONFIGURATION ..... 1-2

1.6. DUAL ANTENNA ARBITRATOR ..... 1-3

1.7. OPEN ANTENNA-MODEM INTERFACE PROTOCOL (OPENAMIP™) SPECIFICATION: ..... 1-3

*1.7.1. Overview: ..... 1-3*

*1.7.2. Interface requirements: ..... 1-4*

*1.7.3. Utilized OpenAMIP™ Commands: ..... 1-4*

**2. SITE SURVEY ..... 2-1**

2.1. SITE SELECTION ABOARD THE SHIP ..... 2-1

2.2. ANTENNA SHADOWING (BLOCKAGE) AND RF INTERFERENCE ..... 2-1

2.3. MOUNTING FOUNDATION ..... 2-2

*2.3.1. Mounting on Deck or Deckhouse ..... 2-2*

*2.3.2. ADE Mounting Considerations ..... 2-2*

*2.3.3. Sizing of the support pedestal ..... 2-2*

2.4. MOUNTING HEIGHT ..... 2-3

2.5. MAST CONFIGURATIONS ..... 2-3

*2.5.1. Vertical Masts ..... 2-4*

*2.5.2. Raked Masts ..... 2-4*

*2.5.3. Girder Masts ..... 2-4*

*2.5.4. Truss Mast ..... 2-5*

2.6. SAFE ACCESS TO THE ADE ..... 2-5

2.7. BELOW DECKS EQUIPMENT LOCATION ..... 2-5

2.8. CABLES ..... 2-5

*2.8.1. ADE/BDE Coaxial Cables ..... 2-6*

*2.8.2. Antenna Power Cable ..... 2-6*

*2.8.3. Air Conditioner Power Cable ..... 2-6*

*2.8.4. ACU Power Cable/Outlet ..... 2-6*

*2.8.5. Gyro Compass Cable ..... 2-6*

2.9. GROUNDING ..... 2-7

**3. INSTALLATION ..... 3-1**

3.1. UNPACKING AND INSPECTION ..... 3-1

3.2. ASSEMBLY NOTES AND WARNINGS ..... 3-1

3.3. INSTALLING THE ADE ..... 3-2

*3.3.1. Prepare the 50", 60", 66" or 76" Radome Assembly ..... 3-2*

*3.3.2. Installing the 50, 60 or 66" Radome Assembly ..... 3-3*

3.4. GROUNDING THE PEDESTAL ..... 3-6

3.5. REMOVING THE SHIPPING/STOW RESTRAINTS ..... 3-7

*3.5.1. Removing the AZ Shipping/Stow Restraint ..... 3-7*

*3.5.2. Removing the EL Shipping/Stow Restraint ..... 3-8*

*3.5.3. Removing the CL Shipping/Stow Restraint ..... 3-10*

3.6. INSTALLING THE BELOW DECKS EQUIPMENT. ..... 3-10

*3.6.1. General Cautions & Warnings ..... 3-10*

*3.6.2. Preparing BDE Location ..... 3-10*

*3.6.3. System Configuration ..... 3-11*

*3.6.4. Installing the Below Deck Equipment ... 3-11*
3.7. CONNECTING THE BELOW DECKS EQUIPMENT ... 3-11
*3.7.1. Connecting the ADE AC Power Cable ... 3-11*
*3.7.2. Connecting the BDE AC Power Cables ... 3-11*
*3.7.3. Connecting the ADE IF Coaxes ... 3-12*
*3.7.4. Connect the Modem TXIF Coax ... 3-12*
*3.7.5. Antenna Control Unit Connections ... 3-12*
*3.7.6. 133BURadio Control Serial Cable ... 3-12*
*3.7.7. Terminal Mounting Strip (TMS) Connections ... 3-12*
*3.7.8. Other BDE connections ... 3-15*
3.8. FINAL CHECKS ... 3-16
*3.8.1. Visual/Electrical inspection ... 3-16*
*3.8.2. Electrical - Double check wiring connections ... 3-16*
3.9. POWER-UP ... 3-16
3.10. 61BANTENNA MAINTENANCE ... 3-16
*3.10.1. Balancing the Antenna ... 3-16*
*3.10.2. Fine Balance and Monitoring Motor Drive Torque ... 3-17*
**4. BASIC SETUP OF THE ACU ... 4-1**
4.1. OPERATOR SETTINGS ... 4-1
4.2. SETUP PARAMETER DISPLAY AND ENTRY MENUS. ... 4-1
4.3. DEFAULT SETUP PARAMETERS FOR YOUR ANTENNA ... 4-1
4.4. SAVE NEW PARAMETERS ... 4-2
**5. SETUP – SHIPS GYRO COMPASS ... 5-1**
5.1. GYRO TYPE ... 5-1
5.2. UPDATING THE GYRO TYPE PARAMETER ... 5-1
5.3. IF THERE IS NO SHIPS GYRO COMPASS ... 5-1
**6. SETUP – TRACKING RECEIVER – VSAT ... 6-1**
6.1. DETERMINING THE IF TRACKING FREQUENCY (MHZ) ... 6-1
6.2. KHZ ... 6-1
6.3. FEC ... 6-1
*6.3.1. L-Band SCPC Receiver ... 6-1*
6.4. TONE ... 6-1
*6.4.1. VSAT Application ... 6-1*
6.5. VOLT ... 6-2
*6.5.1. VSAT Application ... 6-2*
6.6. SAT SKEW ... 6-2
6.7. NID ... 6-2
**7. SETUP – BAND SELECTION ... 7-1**
7.4. CROSS-POL ONLY QUAD-BAND LNB ... 7-2
7.8. CROSS-POL AND CO-POL QUAD-BAND LNBS ... 7-3
**8. SETUP – TARGETING ... 8-1**
8.1. AUTO TRIM ... 8-1
8.2. MANUALLY OPTIMIZING TARGETING ... 8-1
8.3. EL TRIM ... 8-2
8.4. AZ TRIM ... 8-2
**9. SETUP – HOME FLAG OFFSET ... 9-1**
9.1. ELECTRONIC CALIBRATION OF RELATIVE ANTENNA POSITION (HOME FLAG OFFSET) ... 9-1
*9.1.1. You Found a Large AZ TRIM value: ... 9-1*

*9.1.2. You Observe "Home" Pointing is LEFT of the Bow-line:* ..... *9-2*
*9.1.3. You Observe "Home" Pointing is RIGHT of the Bow-line:* ..... *9-2*
*9.1.4. To Enter the HFO value in the DAC_2202:* ..... *9-3*
9.2. MECHANICAL CALIBRATION OF RELATIVE ANTENNA POSITION (HOME FLAG OFFSET) ..... 9-4
***10.* SETUP – SEARCHING ..... 10-1**
10.1. SEARCHING OPERATION ..... 10-1
*10.1.1. Default Standard (Box) Search Pattern* ..... *10-1*
*10.1.2. Inclined Orbit Search Pattern* ..... *10-2*
*10.1.3. No Gyro Search Pattern* ..... *10-3*
10.2. CHANGING THE SEARCH PARAMETERS ..... 10-4
*10.2.1. AUTO THRES* ..... *10-4*
*10.2.2. EL STEP SIZE* ..... *10-4*
*10.2.3. AZ STEP SIZE* ..... *10-4*
*10.2.4. STEP INTEGRAL* ..... *10-4*
*10.2.5. SEARCH INC* ..... *10-5*
*10.2.6. SEARCH LIMIT* ..... *10-5*
*10.2.7. SEARCH DELAY* ..... *10-5*
*10.2.8. SWEEP INC* ..... *10-5*
10.3. SAVE NEW PARAMETERS ..... 10-5
**11. SETUP – BLOCKAGE & RF RADIATION HAZARD ZONES ..... 11-1**
11.1. RADIATION HAZARD AND BLOCKAGE MAPPING (AZ LIMIT PARAMETERS) ..... 11-1
11.2. SAVE NEW PARAMETERS ..... 11-4
**12. SETUP – MODEM CONNECTIONS, SETUP AND TEST ..... 12-1**
12.1. JUMPER SELECTION ..... 12-1
12.2. IDIRECT MODEMS ..... 12-2
12.3. COMTECH MODEMS ..... 12-2
12.4. HUGHES MODEMS ..... 12-3
12.5. STM MODEMS ..... 12-3
12.6. CONNECTIONS (ACU TO SATELLITE MODEM) ..... 12-3
*12.6.1. iDirect Modems* ..... *12-3*
*12.6.3. Hughes Modems* ..... *12-3*
*12.6.4. STM Modems* ..... *12-4*
12.7. SYSTEM TYPE PARAMETER ..... 12-4
12.8. BLOCKAGE SIMULATION TEST - DAC-2202 ..... 12-5
12.9. TESTING THE SATELLITE MODEM LOCK INPUT - DAC-2202 ..... 12-6
12.10. SAVE NEW PARAMETERS ..... 12-6
**13. SETUP – OPTIMIZING POLARITY & CROSS-POL ISOLATION ..... 13-1**
13.1. SAT SKEW SETTING ..... 13-1
13.2. POLARITY ANGLE (POLANG) PARAMETERS ..... 13-1
13.3. OPTIMIZING AUTO-POLARIZATION ON RECEIVE SIGNAL ..... 13-1
13.4. OPTIMIZING AUTO-POLARIZATION CROSS-POL ISOLATION ..... 13-2
**14. SETUP – OTHER PARAMETERS ..... 14-1**
14.1. SETUP PARAMETER DISPLAY AND ENTRY MENUS ..... 14-1
14.2. 5V OFFSET (MAY NOT BE IN YOUR SOFTWARE) ..... 14-1
14.3. 5V SCALE (MAY NOT BE IN YOUR SOFTWARE) ..... 14-1
14.4. REMOTE COMMAND ..... 14-1
14.5. REMOTE MONITOR ..... 14-1
14.6. TO DISABLE/ENABLE DISHSCAN® ..... 14-1

14.7. Satellite Reference Mode ..... 14-2
14.8. REMOTE PARAMETERS ..... 14-2
**15. FUNCTIONAL TESTING ..... 15-1**
15.1. ACU / Antenna System Check ..... 15-1
15.2. Latitude/Longitude Auto-Update check ..... 15-1
15.3. Heading Following ..... 15-1
15.4. Four Quadrant Tracking Test ..... 15-1
15.5. Blockage Simulation Test ..... 15-2
15.6. Test Broadband Operation ..... 15-3
15.7. Test Voice Over IP (VOIP) Operation ..... 15-3
**16. INSTALLATION TROUBLESHOOTING ..... 16-1**
16.1. Warranty Information ..... 16-1
16.2. Troubleshooting The ACU ..... 16-1
*16.2.1. ACU display is blank ..... 16-2*
*16.2.2. ACU Status displays "REMOTE NOT RESPONDING" ..... 16-2*
16.3. Troubleshooting Ships Gyro Compass problems ..... 16-2
*16.3.1. STEP-BY-STEP ..... 16-2*
*16.3.2. 1:1 SYNCHRO ..... 16-2*
*16.3.3. 360:1 Synchro ..... 16-3*
**17. STOWING THE ANTENNA ..... 17-1**
17.1. Installing the Stow Restraints ..... 17-1
*17.1.1. Installing the AZ Shipping/Stow Restraint ..... 17-1*
*17.1.2. Installing the EL Shipping/Stow Restraint ..... 17-2*
*17.1.3. Installing the CL Shipping/Stow Restraint ..... 17-4*
17.2. Removing the Shipping/Stow Restraints PRIOR to Power-Up ..... 17-4
*17.2.1. Removing the AZ Shipping/Stow Restraint ..... 17-5*
*17.2.2. Removing the EL Shipping/Stow Restraint ..... 17-5*
*17.2.3. Removing the CL Shipping/Stow Restraint ..... 17-7*
**18. BLUETOOTH INSTALLATION & OPERATION ..... 18-1**
18.1. Prerequisites ..... 18-1
18.2. Installing the ADE Bluetooth Hardware ..... 18-1
18.3. Installing the BDE Bluetooth Hardware ..... 18-2
18.4. Diagnostic Mode ..... 18-2
18.5. Removing the ADE Bluetooth Hardware ..... 18-3
18.6. Removing the BDE Bluetooth Hardware ..... 18-3
18.7. Installing Software via Bluetooth ..... 18-3
18.8. Normal Operation Mode ..... 18-4
**19. DAC-2202 TECHNICAL SPECIFICATIONS ..... 19-1**
19.1. DAC-2202 Antenna Control Unit ..... 19-1
*19.1.1. General ..... 19-1*
*19.1.2. Front Panel ..... 19-1*
*19.1.3. Rear Panel ..... 19-1*
*19.1.4. J4A "Antenna" Pedestal M&C Interface ..... 19-1*
*19.1.5. J4B "Antenna" Pedestal M&C Interface ..... 19-2*
*19.1.6. J3 "M&C" Aux Serial Interface ..... 19-2*
*19.1.7. J2 "NMEA A" Interface ..... 19-2*
*19.1.8. J2 "NMEA B" Interface ..... 19-2*
*19.1.9. Ethernet ..... 19-2*

*19.1.10. DVB Compliant Tracking Receiver* ..... *19-3*
*19.1.11. L-Band SCPC Narrow Band Tracking Receiver* ..... *19-3*
*19.1.12. Narrow Band SCPC receiver (DAC-2302 ONLY):* ..... *19-3*
19.2. TERMINAL MOUNTING STRIP ..... 19-3
*19.2.1. Synchro Interface:* ..... *19-3*
*19.2.2. SBS Interface* ..... *19-4*
*19.2.3. Control Interface* ..... *19-4*
*19.2.4. NMEA Interface* ..... *19-4*
19.3. ENVIRONMENTAL CONDITIONS ..... 19-5
19.4. DAC-2202 AC POWER CONSUMPTION ..... 19-5
19.5. CABLES ..... 19-5
*19.5.1. IF Signal Cables* ..... *19-5*
*19.5.2. SBS/Synchro Gyro Compass Interface Cable (Customer Furnished)* ..... *19-5*
**20. 4009-91 TECHNICAL SPECIFICATIONS ..... 20-1**
20.1. ANTENNA REFLECTOR/FEED 4009 ..... 20-1
20.2. SMW QUAD BAND LNB ..... 20-1
20.3. TX RADIO PACKAGE ( -91 SYSTEMS) ..... 20-2
*20.3.1. OPTIONAL 7550 M&C Interface Unit* ..... *20-2*
*20.3.2. OPTIONAL 7552 FSK to USB M&C Interface Unit* ..... *20-2*
20.4. BUC POWER SUPPLY ..... 20-2
20.5. CO-POL EQUIPMENT ..... 20-2
20.6. MK 2 PEDESTAL CONTROL UNIT (PCU) ..... 20-2
20.7. 400 MHZ BASE & PEDESTAL UNLIMITED AZIMUTH MODEMS (3 CHANNEL) ..... 20-3
20.8. MK 2 MOTOR DRIVER ENCLOSURE (MDE) ..... 20-3
20.9. STABILIZED ANTENNA PEDESTAL ASSEMBLY ..... 20-4
20.10. RADOME ASSEMBLY, 50" ..... 20-5
20.11. ADE PEDESTAL POWER REQUIREMENTS: ..... 20-5
20.12. XX09 ENVIRONMENTAL SPECIFICATIONS ..... 20-6
*20.12.1. Climatic Conditions* ..... *20-6*
*20.12.2. Chemically Active Substances* ..... *20-6*
*20.12.3. Mechanical Conditions* ..... *20-6*
*20.12.4. Transit Conditions* ..... *20-6*
20.13. BELOW DECKS EQUIPMENT ..... 20-7
*20.13.1. Antenna Control Unit (ACU)* ..... *20-7*
*20.13.2. Terminal Mounting Strip (TMS)* ..... *20-7*
*20.13.3. Satellite Modem* ..... *20-7*
*20.13.4. Router* ..... *20-7*
20.14. CABLES ..... 20-7
*20.14.1. Antenna Control Cable (Provided from ACU to the Base MUX)* ..... *20-7*
*20.14.2. Antenna L-Band IF Coax Cables (Customer Furnished)* ..... *20-7*
*20.14.3. Multi-conductor Cables (Customer Furnished)* ..... *20-8*
**21. DRAWINGS ..... 21-1**
21.1. DAC-2202 ANTENNA CONTROL UNIT DRAWINGS ..... 21-1
21.2. 4009-91 KU-BAND MODEL SPECIFIC DRAWINGS ..... 21-1
21.3. SERIES 09 GENERAL DRAWINGS ..... 21-1

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# 1. 09 Series System Configuration(s)

The 09 Series Stabilized Antenna system is to be used for Transmit/Receive (TX/RX) satellite communications, it is comprised of two major groups of equipment. These are the Above Decks Equipment (ADE) and the Below Decks Equipment (BDE). There will also be interconnecting cables between the ADE & BDE and cables to provide other inputs to the system.

## *1.1. Series 09 Basic System Information*

Series 09 Antennas will be available in 3 dish sizes (Diameter – active area):

- 1.0 M (40 inch)
- 1.2 M (50.0 inch)
- 1.5 M (60 inch)

Each dish size will be available in multiple configurations:

- Variety of BUC manufacturers and power output capabilities
- Variety of BUC/HPA power output capabilities
- Cross-Pol Feed assembly
- Optional Co-Pol diplexer and LNB
- Choice of Single fixed frequency, dual-band, tri-band or Quad-Band LNB(s)

The Series 09 antennas are available in multiple tuned radome sizes:

- 131.3 cm (50 inches) Diameter
- 155 cm (60 inch) Diameter
- 1.76 M (66 inch) Diameter
- 201.59cm (76 inch) Diameter
- 205.23cm (81 inch) Diameter **[Air Conditioning available for this radome *ONLY*]**

## *1.2. System Cables*

AC Power & Coaxial cables will be discussed in a separate chapter.

## *1.3. Other Inputs to the System*

Multi-conductor cables from Ships Gyro Compass, GPS, phone, fax and Computer equipment may also be connected in the system.

## *1.4. Simplified block diagram of a Series 09 system*

Your Series 09 TXRX system consists of two major groups of equipment; an above-decks group and a below-decks group. Each group is comprised of, but is not limited to, the items listed below. All equipment comprising the Above Decks is incorporated inside the radome assembly and is integrated into a single operational entity. For inputs, this system requires only an unobstructed line-of-sight view to the satellite, Gyro Compass input and AC electrical power.

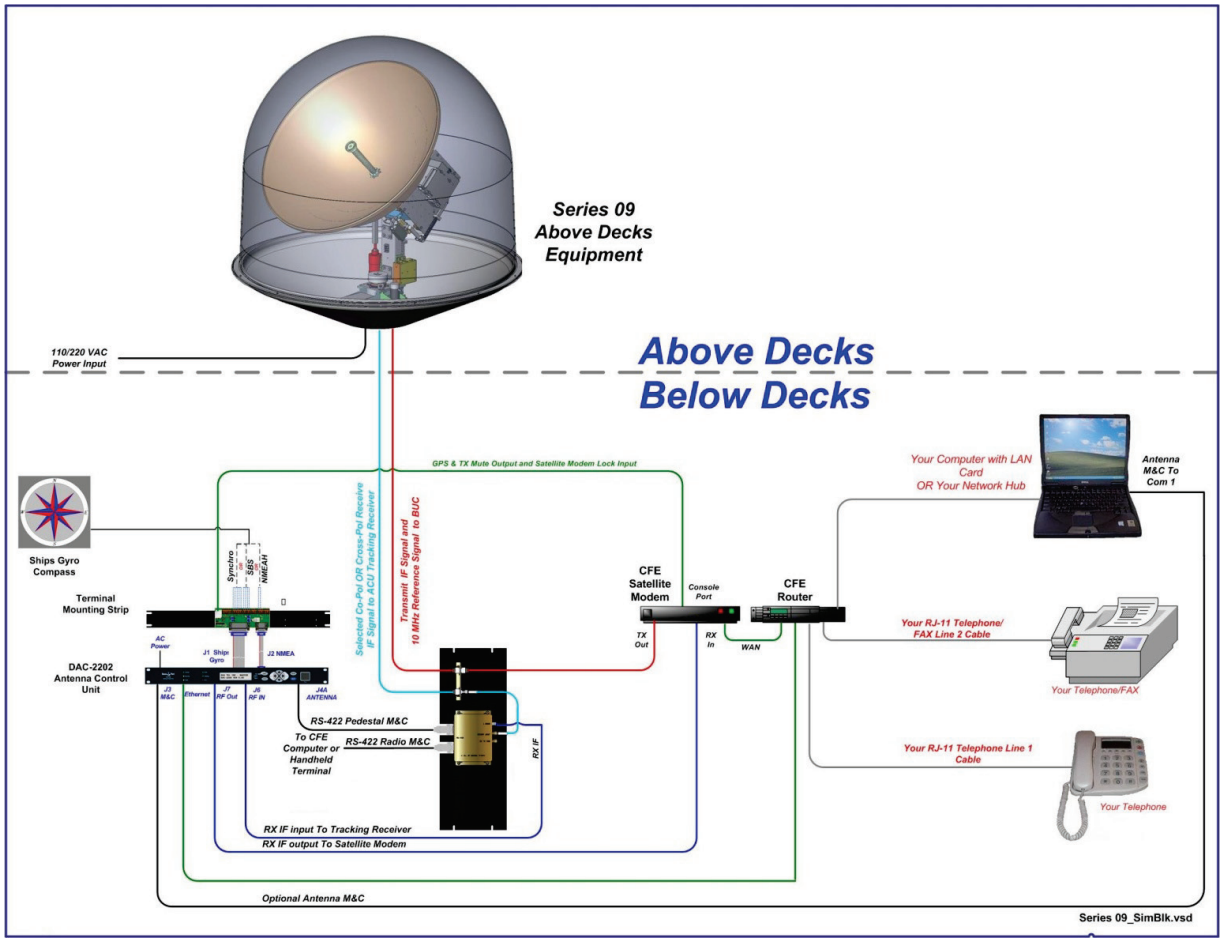
A. Above-Decks Equipment (all shown as the ADE) Group

- Stabilized antenna pedestal
- Antenna Reflector
- Feed Assembly with Cross-Pol LNB
- Co-Pol LNB (xx09-17 & 33 Only
- 8W Ku-Band Solid State Block Up-Converter (BUC)
- Radome Assembly

B. Below-Decks Equipment Group

- Antenna Control Unit
- Terminal Mounting Strip Assembly.
- Base Modem Panel

- Customer Furnished Equipment - Satellite Modem and other below decks equipment required for the desired communications purposes (including LAN and VOIP equipment).
- Appropriate Coax, Ethernet, and telephone cables

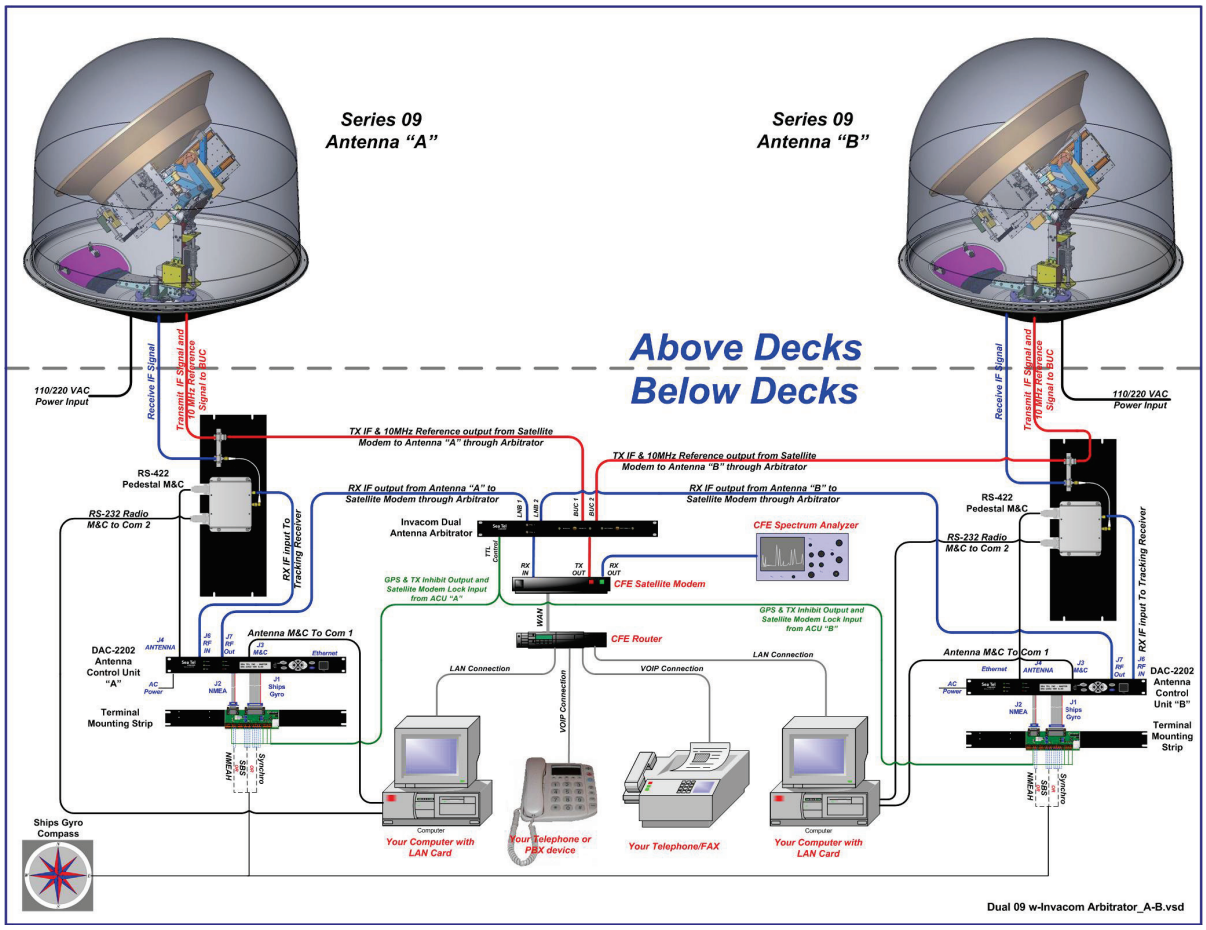



## *1.5. Dual Antenna Configuration*

Sometimes, due to very large blockage conditions, you may need to install a dual antenna configuration to provide uninterrupted services. Two full antenna systems are installed and the ACU control outputs are connected to an arbitrator switch panel which then is connected to the below decks equipment. NOTE: The RXIF from EACH antenna MUST be connected to the RF IN (J6) on the rear panel of its respective ACU then RFOUT (J7) is connected to the RXIF input of the Dual Antenna Arbitrator. This connection scheme is required for ACU "A" to be able to control Antenna "A" (and ONLY Antenna "A") AND ACU "B" to be able to control Antenna "B" (and ONLY Antenna "B").

You will program the blockage zone(s) for each of the two antennas (refer to Setup – Blockage Zones). The blockage output from the ACU is fed to the Terminal Mounting Strip so that the output of each ACU can be connected to the arbitrator panel to control it. The blockage output is available on SW2 terminal of the Terminal Mounting Strip to provide a transistor "short" to ground when the antenna is within a blockage zone programmed into the ACU. When not blocked the SW2 terminal will be an "open".

When one antenna is blocked, its blockage output will command the arbitrator panel to switch services to the modem from that antenna to the other antenna. The arbitrator panel provides a logic latch to prevent excess switching when the ship heading is yawing, therefore, causing if the antenna to be repeatedly blocked – unblocked – blocked.




## 1.6. Dual Antenna Arbitrator

The Dual Antenna Arbitrator panel can pass LNB voltages (and handle 250-400 ma of current) and the RXIF signals on the RX connections. TXIF, Reference and BUC supply voltage can be passed through this arbitrator panel to the antenna, but it is not recommended that BUC power be supplied through the dual channel rotary joint of the antenna (a BUC power supply is provided on all Series 09 Antenna Pedestals).

The blockage (SW2) output, GPS output and Modem lock input from the two terminal mounting strips (antenna "A" and antenna "B") are wired through the arbitrator panel to the satellite modem. When antenna "A" is blocked, the arbitrator PCB will toggle the coax switches so that antenna "B" provides signal to the BDE distribution (multi-switch or modem). When antenna "A" is no longer blocked the arbitrator will do nothing (because it is a latch circuit). When antenna "B" is blocked the panel will switch so that antenna "A" is again providing signal the BDE distribution.

To provide a seamless switching transition, refer to the arbitrator installation instructions to balance the TX & RX signal levels between the two antennas.

## 1.7. Open Antenna-Modem Interface Protocol (OpenAMIP™) Specification:

### 1.7.1. Overview:

OpenAMIP™, an ASCII message based protocol invented and Trademarked by iDirect is a specification for the interchange of information between an antenna controller and a satellite modem. This protocol allows the satellite modem to command the ACU (via TCP port 2002) to seek a particular satellite as well as allowing exchange of information necessary to permit the modem to initiate and maintain communication via the antenna and the satellite. In general, OpenAMIP™ is not intended for any purpose except to permit a modem and the ACU to perform synchronized automatic beam switching. It is ***NOT*** a status logging system

or a diagnostic system. In addition, OpenAMIP™ is intended for a typical installation whereby a specific satellite modem and Antenna system are properly configured to work together. The protocol does not make specific provisions for auto-discovery or parameter negotiation. It is still the responsibility of the installer to ensure that the parameters of both the satellite modem (proper option files) and the ACU/PCU (setup parameters) are actually compatible for the intended satellite(s).

### 1.7.2. Interface requirements:

#### *1.7.2.1. Hardware*

Sea Tel Antenna Control Units Model DAC-2202 or DAC-2302.

Any Satellite modem manufacturer that is compatible with OpenAMIP™

CAT5 Patch cable

#### *1.7.2.2. Software*

Sea Tel model DAC-2202:

ACU software version 6.06 or greater

CommIF module software version 1.10f or greater

Sea Tel model DAC-2302:

ACU software version 7.06 or greater

CommIF module software version 1.10f or greater

### 1.7.3. Utilized OpenAMIP™ Commands:

#### *1.7.3.1. Antenna Commands:*

| Command | Description | Example |
|---|---|---|
| S f1 f2 f3 | Satellite Longitude, 3 parameters:<br>Degrees E/W (-value equals West), Latitude Variance (Inclined Orbit), Sat Skew Offset | "S -20.1 1.0 3.5" |
| P c1 c2 | Polarization, 2 parameters:<br>H,V,L,, or R | "P L R" |
| H f1 f2 | Tracking Frequency: 2 Parameters:<br>Center Frequency and Bandwidth in MHz | "H 1100.500 0.256" |
| B f1 f2 | Down Conversion Offset: 2 parameters:<br>LNB (Receive) Local Oscillator and BUC (TX) L.O. | "B 10750" |
| F | Find,<br>Target satellite using existing S, P,R, and H Parameters | |
| A i | Set keep alive in seconds (0 = off) | "A 5" |
| L b1 b2 | Modem Lock and free to transmit. 2 parameters:<br>b1 indicates Rx lock and b2 (not utilized) enables/disables Tx Mute to BUC | "L 1 1" |
| W i | GPS Update:<br>Sets GPS Update period in seconds (0 = Off) | "W 300" |
| I s1 s2 | Set modem vendor (s1) and device (s2) 2 parameters: | "I iDirect 5100" |

### *1.7.3.2. Modem Commands:*

| Command | Description | Example |
|---|---|---|
| a i | Set keep alive in seconds (0 = off) | "a 5" |
| i s1 s2 | Set Antenna Vendor (s1) and device (s2) 2 parameters: | "i Sea Tel DAC-2202" |
| s b1 b2 | Antenna Status: 2 parameters:<br>b1 is functional status and b2 is Tx allowed | "s 1 1" |
| w b1 f1 f2 t1 | Set GPS Position: 4 parameters:<br>b1 is validity flag, f1 is latitude, f2 is longitude, and t1 is timestamp | "w 1 38.222 122.123 0" |

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# 2. Site Survey

The objective of the Site survey is to find the best place to mount the antenna & the below decks equipment, the length and routing of the cables and any other items or materials that are required to install the system and identify any other issues that must be resolved before or during the installation.

## *2.1. Site Selection Aboard The Ship*

The radome assembly should be installed at a location aboard ship where:

- The antenna has a clear line-of-sight to view as much of the sky (horizon to zenith at all bearings) as is practical.
- X-Band (3cm) Navigational Radars:
  - The ADE should be mounted more than 0.6 meters/2 feet from 2kW (24 km) radars
  - The ADE should be mounted more than 2 meters/8 feet from 10kW (72 km) radars
  - The ADE should be mounted more than 4 meters/12 feet from 160kW (250km) radars
- S-Band (10cm) Navigational Radars:
  - If the ADE is/has C-Band it should be mounted more than 4 meters/12 feet from the S-band Radar.
- The ADE should not be mounted on the same plane as the ship's Radar, so that it is not directly in the Radar beam path.
- The ADE should be mounted more than 2.5 meters/8 feet from any high power MF/HF antennas (<400W).
- The ADE should be mounted more than 4 meters/12 feet from any high power MF/HF antennas (1000W).
- The ADE should also be mounted more than 4 meters/12 feet from any short range (VHF/UHF) antennae.
- The ADE should be mounted more than 2.5 meters/8 feet away from any L-band satellite antenna.
- The ADE should be mounted more than 3 meters/10 feet away from any magnetic compass installations.
- The ADE should be mounted more than 2.5 meters/8 feet away from any GPS receiver antennae.
- Another consideration for any satellite antenna mounting is multi-path signals (reflection of the satellite signal off of nearby surfaces arriving out of phase with the direct signal from the satellite) to the antenna. This is particularly a problem for the onboard GPS, and/or the GPS based Satellite Compass.
- The Above Decks Equipment (ADE) and the Below Decks Equipment (BDE) should be positioned as close to one another as possible. This is necessary to reduce the losses associated with long cable runs.
- This mounting platform must also be robust enough to withstand the forces exerted by full rated wind load on the radome.
- The mounting location is robust enough that it will not flex or sway in ships motion and be sufficiently well re-enforced to prevent flex and vibration forces from being exerted on the antenna and radome.
- If the radome is to be mounted on a raised pedestal, it ***MUST*** have adequate size, wall thickness and gussets to prevent flexing or swaying in ships motion. In simple terms it must be robust.

If these conditions cannot be entirely satisfied, the site selection will inevitably be a "best" compromise between the various considerations.

## *2.2. Antenna Shadowing (Blockage) and RF Interference*

At the transmission frequencies of C and Ku band satellite antenna systems, any substantial structures in the way of the beam path will cause significant degradation of the signal. Care should be taken to locate the ADE so that the ADE has direct line-of-sight with the satellite without any structures in the beam path through the full 360 degree ships turn. Wire rope stays, lifelines, small diameter handrails and other accessories may pass through the beam path in limited numbers; however, even these relatively insignificant shadows can produce measurable signal loss at these frequencies.

## *2.3. Mounting Foundation*

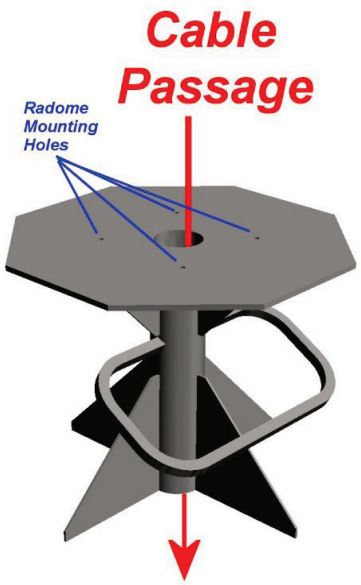
### 2.3.1. Mounting on Deck or Deckhouse

While mounting the ADE on a mast is a common solution to elevate the ADE far enough above the various obstructions which create signal blockages, sometimes the best mounting position is on a deck or deckhouse top. These installations are inherently stiffer than a mast installation, if for no other reason than the design of the deck/deckhouse structure is prescribed by the ship's classification society. In the deck/deckhouse design rules, the minimum plating and stiffener guidelines are chosen to preclude high local vibration amplitudes.

Most installations onto a deck or deckhouse structure will require a mounting pedestal to raise the ADE above the deck for radome hatch access and to allow the full range of elevation (see ADE mounting considerations above). Some care must be taken to ensure the mounting pedestal is properly aligned with the stiffeners under the deck plating.

### 2.3.2. ADE Mounting Considerations

Mounting the radome directly on the deck, or platform prevents access to the hatch in the base of the radome unless an opening is designed into the mounting surface to allow such entry. If there is no access to the hatch the only way to service the antenna is to remove the radome top. Two people are required to take the top off of the radome without cracking or losing control of it, but even with two people a gust of wind may cause them to lose control and the radome top may be catastrophically damaged (see repair information in the radome specifications).




If access to the hatch cannot be provided in the mounting surface, provide a short ADE support pedestal to mount the ADE on which is tall enough to allow access into the radome via the hatch.

Ladder rungs must be provided on all mounting stanchions greater than 3-4 feet tall to allow footing for personnel safety when entering the hatch of the radome.

The recommended cable passage in the 50, 60 and 66 inch radomes is through the bottom center of the radome base, down through the ADE support pedestal, through the deck and into the interior of the ship.

### 2.3.3. Sizing of the support pedestal

The following should be taken into account when choosing the height of a mounting support stand:

1. The height of the pedestal should be kept as short as possible, taking into account recommendations given in other Sea Tel Guidelines.
2. The minimum height of the pedestal above a flat deck or platform to allow access into the radome for maintenance should be 0.6 meters (24 inches).
3. The connection of the ADE mounting plate to the stanchion and the connection of the pedestal to the ship should be properly braced with triangular gussets (see graphic above). Care should be taken to align the pedestal gussets to the ship's stiffeners as much as possible. Doublers or other reinforcing plates should be considered to distribute the forces when under-deck stiffeners are inadequate.
4. The diameter of the pedestal stanchion shall not be smaller than 100 millimeters (4 inches). Where the ADE base diameter exceeds 1.5 meters (60 inches), additional stanchions (quantity greater than 3) should be placed rather than a single large stanchion.
5. Shear and bending should be taken into account in sizing the ADE mounting plate and associated gussets.
6. Shear and bending must be taken into account when sizing the pedestal to ship connection.
7. All welding should be full penetration welds –V-groove welds with additional fillet welds – with throats equivalent to the thickness of the thinnest base material.
8. For an ADE mounted greater than 0.6 meters (24 inches) above the ship's structure, at least one (1)

foot rung should be added. Additional rungs should be added for every 0.3 meter (12 inches) of pedestal height above the ship's structure.

9. For an ADE mounted greater than 3 meters (9 feet) above the ship's structure, a fully enclosing cage should be included in way of the access ladder, starting 2.3 meters (7 feet) above the ship's structure.

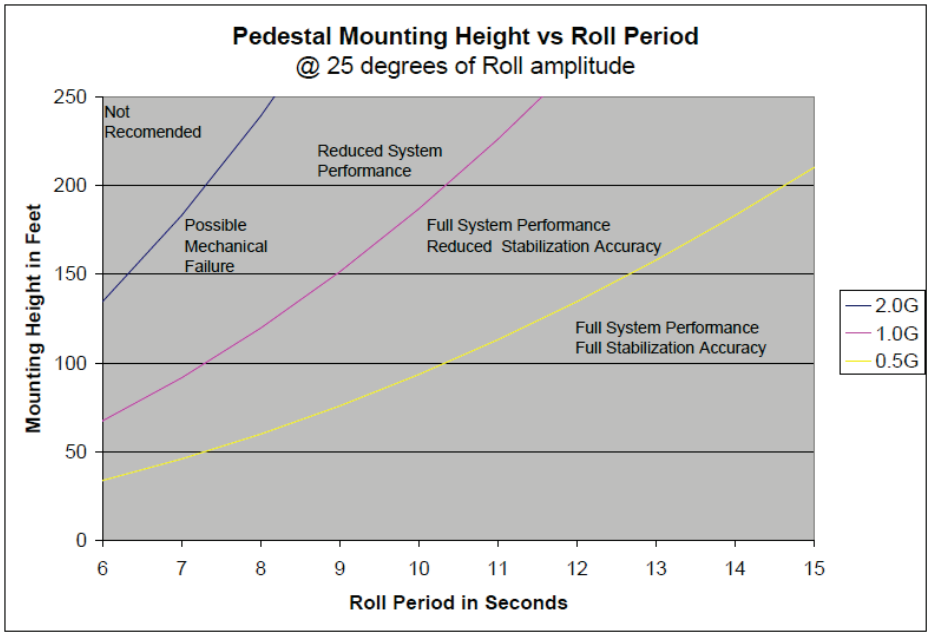
## *2.4. Mounting Height*

The higher up you mount the antenna above the pivot point of the ship the higher the tangential acceleration (g-force) exerted on the antenna will be (see chart below).

When the g-force exerted on the antenna is light, antenna stabilization and overall performance will not be affected.

If the g-force exerted on the antenna is high enough (> 1 G), antenna stabilization and overall performance will be affected.

If the g-force exerted on the antenna is excessive (1-2 Gs), the antenna will not maintain stabilization and may even be physically damaged by the g-force.




## *2.5. Mast Configurations*

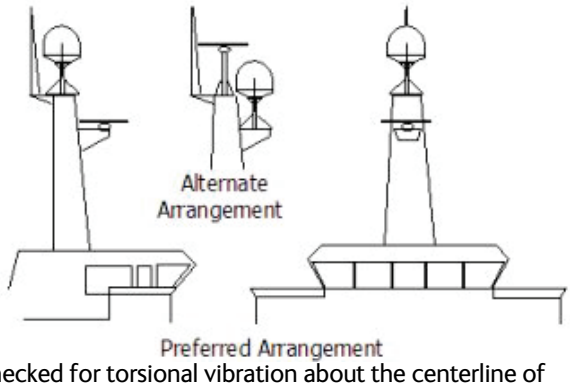
Sea Tel recommends the ADE be mounted on the ship in a location which has both a clear line-of-sight to the target satellites in all potential azimuth/elevation ranges and sufficient support against vibration excitement. If possible, mounting the ADE pedestal directly to ship deckhouse structures or other box stiffened structures is preferred. However, in many cases, this imposes limits on the clear line-of-sight the antenna system has.

Often the solution for providing the full azimuth/elevation range the antenna needs is to mount the ADE on the ship's mast. Unfortunately, masts do not consider equipment masses in design and often have harmonic frequencies of their own.

There are many designs of masts used on ships – masts are nearly as unique in design as the ship is – but the designs often fall into just a few categories. These categories can be addressed in terms of typical responses and problems with regards to vibration and mounting of ADE. The most common categories of masts are:

### 2.5.1. Vertical Masts

Vertical masts are a very ancient and common mast design. In essence, it is the mast derived from the sailing mast, adapted for mounting the ever-increasing array of antennae ships need to communicate with the world. This drawing of a Vertical mast shows preferred mounting of the ADE center-line above the plane of the radar, or as an alternate with the ADE mounted below the plane of the radar signal, as reasonably good installations of a satellite antenna ADE.

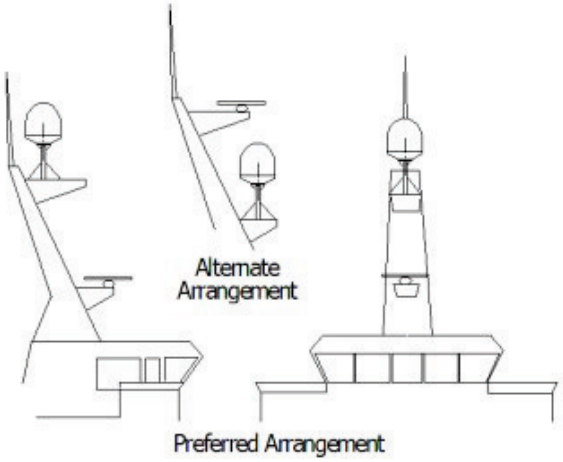



Vertical masts are most commonly still found on cargo ships – they are simple, inelegant and functional. They are also fairly stiff against torsional reaction and lateral vibrations, as long as the ADE is mounted on a stiff pedestal near the vertical centerline of the mast. If centerline mounting is impractical or otherwise prohibited, the mast platform the ADE is mounted on should be checked for torsional vibration about the centerline of the mast and the orthogonal centerline of the platform.

If the estimated natural frequency of the mast or platform is less than 35 Hertz, the mast or platform should be stiffened by the addition of deeper gussets under the platform or behind the mast.

### 2.5.2. Raked Masts

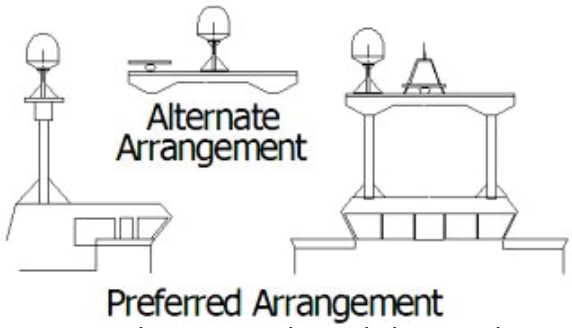
Raked masts are found on vessels where the style or appearance of the entire vessel is important. Again, the inclined mast is a direct descendant from the masts of sailing ships – as ship owners wanted their vessels to look more unique and less utilitarian, they 'raked' the masts aft to make the vessel appear capable of speed. This drawing shows a raked mast, again with the preferred ADE mounting above the radar and alternate with the ADE below the radar.




Raked masts pose special problems in both evaluating the mast for stiffness and mounting of antennae. As can be seen in the drawing all antennae must be mounted on platforms or other horizontal structures in order to maintain the vertical orientation of the antenna centerline. This implies a secondary member which has a different natural frequency than the raked mast natural frequency. In order to reduce the mass of these platforms, they tend to be less stiff than the main box structure of the raked mast. Thus, they will have lower natural frequencies than the raked mast itself. Unfortunately, the vibratory forces will act through the stiff structure of the raked mast and excite these lighter platforms, to the detriment of the antenna.

### 2.5.3. Girder Masts

Girder masts are large platforms atop a pair of columns. Just like girder constructions in buildings, they are relatively stiff athwart ship – in their primary axis – but less stiff longitudinally and torsionally. An example of a girder mast is shown in this drawing, with the preferred ADE mounting outboard and above the radar directly on one of the columns and alternate with the ADE centered on the girder above the plane of the radar.




The greatest weakness of girder masts is in torsion – where the girder beam twists about its vertical centerline axis. As with all mast designs discussed so far, mounting the antenna in line with the vertical

support structure will reduce the vibration tendencies. Mounting the antenna directly above the girder columns provides ample support to the antenna pedestal and locates the antenna weight where it will influence the natural frequency of the mast the least.

### 2.5.4. Truss Mast

Truss masts are a variant on the girder mast concept. Rather than a pair of columns supporting a girder beam, the construction is a framework of tubular members supporting a platform on which the antennae and other equipment is mounted. A typical truss mast is shown in this photograph.

Like a girder mast, truss masts are especially stiff in the athwart ship direction. Unlike a girder mast, the truss can be made to be nearly as stiff in the longitudinal direction. Truss masts are particularly difficult to estimate the natural frequency – since a correct modeling includes both the truss structure of the supports and the plate/diaphragm structure of the platform. In general, though, the following guidelines apply when determining the adequate support for mounting an antenna on a truss mast:

1. Antenna ADE pedestal gussets should align with platform stiffeners which are at least 200 millimeters in depth and 10 millimeters in thickness.
2. When possible, the antenna ADE pedestal column should align with a vertical truss support.
3. For every 100 Kilograms of ADE weight over 250 Kilograms, the depth of the platform stiffeners should be increased by 50 millimeters and thickness by 2 millimeters.

Sea Tel does not have a recommended arrangement for a truss mast – the variability of truss mast designs means that each installation needs to be evaluated separately.

## *2.6. Safe Access to the ADE*

Safe access to the ADE should be provided. Provisions of the ship's Safety Management System with regard to men aloft should be reviewed and agreed with all personnel prior to the installation. Installations greater than 3 meters above the deck (or where the access starts at a deck less than 1 meter in width) without cages around the access ladder shall be provided with means to latch a safety harness to a fixed horizontal bar or ring.

The access hatch for the ADE shall be oriented aft, or inboard, when practical. In any case, the orientation of the ADE access hatch shall comply with the SMS guidelines onboard the ship. Nets and other safety rigging under the ADE during servicing should be rigged to catch falling tools, components or fasteners.

## *2.7. Below Decks Equipment Location*

The Antenna Control Unit, Terminal Mounting Strip and Base Modem Panel are all standard 19" rack mount, therefore, preferred installation of these items would be in such a rack. The ACU mounts from the front of the rack. The Terminal Mounting Strip and Base Modem Panel mount on the rear of the rack.

The Satellite Modem, router, VIOP adapter(s), telephone equipment, fax machine, computers and any other associated equipment should also be properly mounted for shipboard use.

Plans to allow access to the rear of the ACU should be considered.

## *2.8. Cables*

During the site survey, walk the path that the cables will be installed along. Pay particular attention to how cables will be installed all along the path, what obstacles will have to have be routed around, difficulties that will be encountered and the overall length of the cables. The ADE should be installed using good electrical practice. Sea Tel recommends referring to IEC 60092-352 for specific guidance in choosing cables and installing cables onboard a ship. Within these guidelines, Sea Tel will provide some very general information regarding the electrical installation.

In general, all cable shall be protected from chaffing and secured to a cableway. Cable runs on open deck or down a mast shall be in metal conduit suitable for marine use. The conduit shall be blown through with dry air prior to passing cable to ensure all debris has been cleared out of the conduit and again after passing the cable to ensure no trapped

moisture exists. The ends of the conduit shall be sealed with cable glands (preferred), mastic or low VOC silicon sealant after the cables have been passed through.

Cables passing through bulkheads or decks shall be routed through approved weather tight glands.

### 2.8.1. ADE/BDE Coaxial Cables

The first concern about the coaxial cables installed between the ADE & BDE is length. This length is used to determine the loss of the various possible coax, Heliax or fiber-optic cables that might be used. You should always provide the lowest loss cables to provide the strongest signal level into the satellite modem.

Signal cable shall be continuous from the connection within the ADE radome, through the structure of the ship to the BDE. Splices, adapters or dummy connections will degrade the signal level and are discouraged.

Be careful of sharp bends that kink and damage the cable. Use a proper tubing bender for Heliax bends.

Penetrations in watertight bulkheads are very expensive, single cable, welded penetrations that must be pressure tested.

Always use good quality connectors that are designed to fit properly on the cables you are using. Poor quality connectors have higher loss, can allow noise into the cable , are easily damaged or fail prematurely.

In as much as is possible, don't lay the coaxes on power cables. Try to have some separation from Inmarsat & GPS cables that are also passing L-band frequencies or Radar cables that may inject pulse repetition noise –as error bits - into your cables.

### 2.8.2. Antenna Power Cable

Be cautious of length of the run, for voltage loss issues, and assure that the gauge of the wires is adequate for the current that is expected to be drawn (plus margin). Antenna power is not required to be from a UPS (same one that supplies power to the below decks equipment), but it is recommended.

Power cable shall comply with the provisions of IEC 60092-350 and -351 in so far as practicable. Power cable may be routed through the same conduit as the signal cable from the junction box to the base of the ADE. Power cables shall pass through separate radome penetrations from the signal cable.

The power cable shall be continuous from the UPS (or closest circuit breaker) to the ADE connections within the radome. The power circuits shall be arranged so that 'active,' 'common' and 'neutral' (ground) legs are all made or broken simultaneously. All circuit legs shall be carried in the same cable jacket.

### 2.8.3. Air Conditioner Power Cable

If your system includes a marine air conditioner (available with the 81 inch radome ONLY), run an AC power cable to it from a breaker, preferably from a different phase of the electrical system than supplies power to the ADE & BDE. Be EXTREMELY cautious of length of the run for voltage loss and gauge of the wires for the current that is expected to be drawn.

Power cable shall comply with the provisions of IEC 60092-350 and -351 in so far as practicable. Power cable may be routed through the same conduit as the signal cable from the junction box to the base of the ADE. Power cables shall pass through separate radome penetrations from the signal cable.

The power cable shall be continuous from the closest circuit breaker to the ADE connections within the radome. The power circuits shall be arranged so that 'active,' 'common' and 'neutral' (ground) legs are all made or broken simultaneously. All circuit legs shall be carried in the same cable jacket.

### 2.8.4. ACU Power Cable/Outlet

The AC power for the ACU and other below decks equipment is not required to be from a UPS (same one that supplies power to the ADE), but it is recommended.

Power cable shall comply with the provisions of IEC 60092-350 and -351 in so far as practicable.

### 2.8.5. Gyro Compass Cable

Use good quality shielded cable (twisted pairs, individually foil wrapped, outer foil with braid overall is best) You only need 2-wire for NMEA signal, 4-wire for Step-By-Step and 5-wire for Synchro ... always use shielded cable. Be cautious of length and gauge of the run for voltage loss issues.

## *2.9. Grounding*

All metal parts of the ADE shall be grounded to bare metal at the mounting pedestal. Grounding straps from the base of the ADE to a dedicated lug on the mounting pedestal are preferred, but grounding may also be accomplished by exposing bare metal under all mounting bolts prior to final tightening. Preservation of the bare metal should be done to prevent loss of ground.

Grounding should be ensured throughout the entire mounting to the hull. While it is presumed the deckhouse is permanently bonded and grounded to the hull, in cases where the deckhouse and hull are of different materials a check of an independent ground bonding strap should be made. Masts should be confirmed to be grounded to the deckhouse or hull.

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# 3. Installation

Your antenna pedestal comes completely assembled in its radome. This section contains instructions for unpacking, final assembly and installation of the equipment. It is highly recommended that installation of the system be performed by trained technicians.

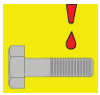
Your antenna may have been ordered in any one of a variety of different diameter radomes. The installation instructions for most common radome sizes for your system are below.

## *3.1. Unpacking and Inspection*

Exercise caution when unpacking the equipment.

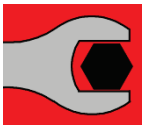
1. Unpack the crates. Carefully inspect the radome surface for evidence of shipping damage.
2. Unpack all the boxes.
3. Inspect everything to assure that all materials have been received and are in good condition.

## *3.2. Assembly Notes and Warnings*



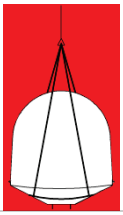
***NOTE**: All nuts and bolts should be assembled using the appropriate Loctite thread-locker product number for the thread size of the hardware.*

| Loctite # | Description |
|---|---|
| 222 | **Low strength for small fasteners.** |
| 242 | **Medium strength** |
| 638 | **High strength for Motor Shafts & Sprockets.** |
| 2760 | **Permanent strength for up to 1" diameter fasteners.** |
| 290 | **Wicking, High strength for fasteners which are already assembled.** |

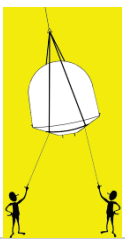


***WARNING**: Assure that all nut & bolt assemblies are tightened according to the tightening torque values listed below:*

| SAE Bolt Size | Inch Pounds | Metric Bolt Size | Kg-cm |
|---|---|---|---|
| 1/4-20 | 75 | M6 | 75.3 |
| 5/I6-18 | 132 | M8 | 150 |
| 3/8-16 | 236 | M10 | 270 |
| 1/2-13 | 517 | M12 | 430 |



***WARNING**: Hoisting with other than a webbed four-part sling may result in catastrophic crushing of the radome. Refer to the specifications and drawings for the fully assembled weight of your model Antenna/Radome and assure that equipment used to lift/hoist this system is rated accordingly.*



***CAUTION**: The antenna/radome assembly is very light for its size and is subject to large swaying motions if hoisted under windy conditions. Always ensure that tag lines, attached to the radome base frame, are attended while the antenna assembly is being hoisted to its assigned location aboard ship.*

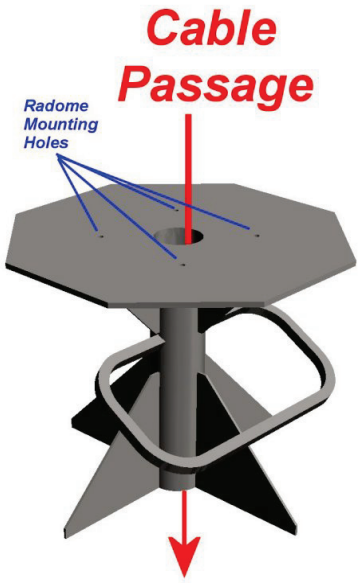
## *3.3. Installing the ADE*

The antenna pedestal is shipped completely assembled in its radome. Please refer to the entire Site Survey chapter of this manual.

**Base Hatch Access** - Mounting the radome directly on the deck, or platform prevents access to the hatch in the base of the radome unless an opening is designed into the mounting surface to allow such entry. If there is no access to the hatch the only way to service the antenna is to remove the radome top. Two people are required to take the top off of the radome without cracking or losing control of it, but even with two people a gust of wind may cause them to lose control and the radome top may be catastrophically damaged (see repair information in the radome specifications) or lost.

If access to the hatch cannot be provided in the mounting surface, provide a short ADE mounting stanchion to mount the ADE on which is tall enough to allow access into the radome via the hatch.

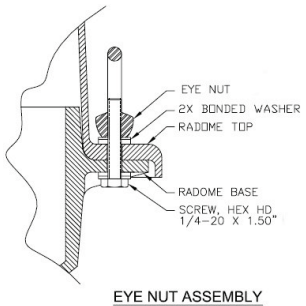
Ladder rungs must be provided on all mounting stanchions greater than 3-4 feet tall to allow footing for personnel safety when entering the hatch of the radome.




**Cable Passage -** The radome base is designed with a bottom center cable passage and Roxtec® Multidiameter® blocks for cable strain relief. The recommended cable passage in the 50, 60, 61 and 66 inch radomes is through the bottom center of the radome base, down through the ADE mounting stanchion, through the deck and into the interior of the ship.

Bottom center cable passage is recommended, however, a strain relief kit is provided with the system if off-center cable entry is required. ***Note: Strain relief installation procedure, provided in the Drawings chapter, MUST be followed to assure that the cored holes are properly sealed to prevent moisture absorption and de-lamination of the radome base.***

### 3.3.1. Prepare the 50", 60", 66" or 76" Radome Assembly

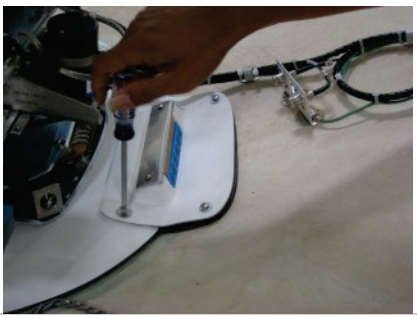
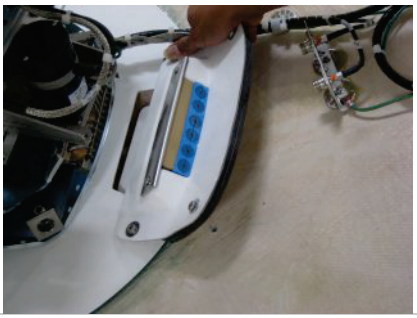
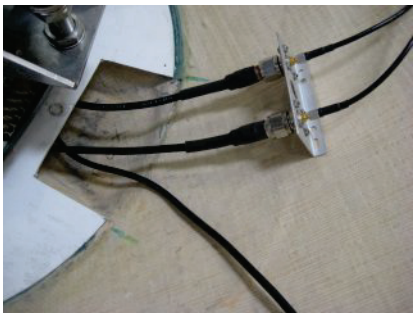
| | |
|---|---|
| 1. Remove the side walls of the Radome crate.<br>2. Lift the pallet using a forklift and/or jacks.<br>3. From the under side of the pallet, remove the 4 shipping bolts which attach the ADE to its' pallet. Discard this shipping hardware. | |
| 4. Remove four equally spaced bolts around the radome flange. Save these nuts and bolts to be re-installed later.<br>5. Install four lifting eyebolts in the vacant holes in the flange of the radome.. (Hardware provided in the radome installation kit). Keep the original perimeter bolt hardware to be re-installed after the ADE has been installed. |  <br>EYE NUT ASSEMBLY |

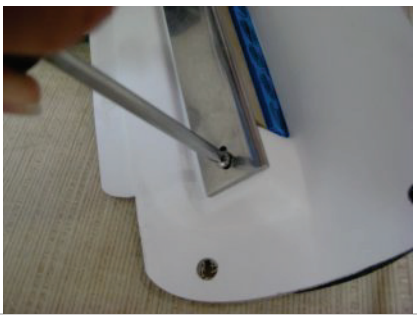
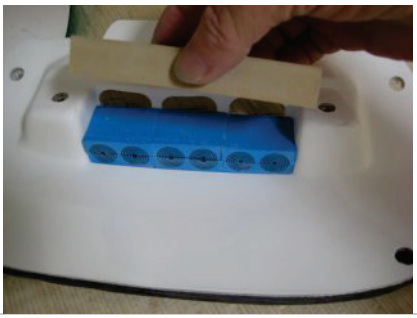
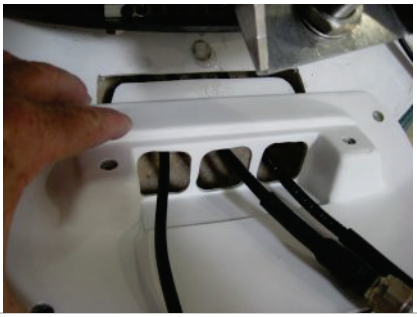
| | |
|---|---|
| 6. Attach shackles and four part web lifting sling arrangement to the eyebolts.<br>7. Attach a suitable length tagline to one of the eyebolts.<br>8. After hoisted into place the lifting eyes are to be removed & replaced with the stainless hardware that was removed in step 4 (the eyes are galvanized with bare thread that will rust if left exposed to the weather). | |

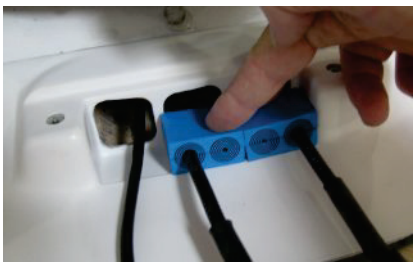
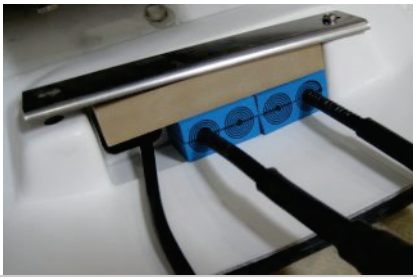
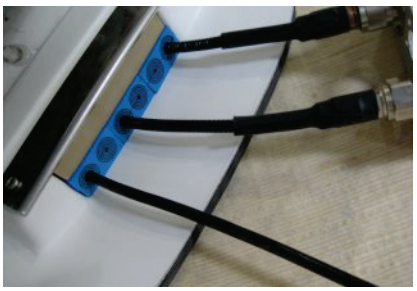
### 3.3.2. Installing the 50, 60 or 66" Radome Assembly

The antenna pedestal is shipped completely assembled in its radome.

| | |
|---|---|
| 1. Man the tag line(s).<br>2. Hoist the antenna assembly off the shipping pallet, by means of a suitably sized crane or derrick, to allow access to bottom of radome assembly.<br>3. Open the hatch by pressing the round release button in the center of the black latches and gently push the hatch up into the radome. Place the hatch door (gel coat surface up) inside the radome on the far side of the antenna pedestal.<br>4. Inspect the pedestal assembly and reflector for signs of shipping damage. | |
| 5. Peel the paper off of the mounting pad (provided in the radome installation kit) to expose the sticky side of the pad, align it to the mounting holes and press it in place on the underside of the radome base. | |
| 6. Using Loctite 271, install the 4 mounting bolts (provided in radome mounting kit) into the radome base. | |

| | |
|---|---|
| 7. Remove the hardware in the cable mounting frame. |  |
| 8. Lift the cable mounting frame out from the cable passage channel.<br>**NOTE: If the bottom center cable passage will NOT be used, it is recommended that the strain reliefs be installed in place of this cable mounting frame. Other locations around the radome base are MUCH thicker, requiring longer strain reliefs than the ones provided by Sea Tel. Refer to the strain relief installation procedure provided in the Drawings chapter of this manual.** |  |
| 9. Man the tag line and have the crane continue lifting the ADE up and hover above the mounting site on the ship.<br>10. Carefully route AC Power, ground strap/cable (see Grounding info below) and IF coax cables through the cable passage in the bottom center of the radome base and through the cable channel under the lower base plate of antenna.<br>**NOTE: Suitable strain relief should be provided below the mounting surface to prevent the cables from being kinked where the cables exit the bottom of the radome.** | |
| 11. Allow enough service loop to terminate these cables to the circuit breaker assembly and connector bracket respectively (see cable termination information below).<br>**HINT: It may be easier to connect, or tie-wrap, the coaxes and power cable temporarily.**<br>12. Lower radome assembly into the mounting holes, positioned with the BOW reference of the radome as close to parallel with centerline of the ship as possible (any variation from actual alignment can be electrically calibrated if needed).<br>13. Using Loctite 271, install the 4 fender washers and hex nuts (provided in the radome installation kit), from the underside of the mounting surface, to affix the radome to the mounting surface. Tighten to torque spec. |  |

| | |
|---|---|
| 14. Remove the clamp bar and Roxtec® Multidiameter® blocks from their cable mounting frame in the cable passage channel. |  |
| 15. Remove the rubber bar from the top of the Roxtec® Multidiameter® blocks. |  |
| 16. Remove the Roxtec® Multidiameter® blocks from the cable mounting frame. | |
| 17. Pass the coaxes and power cable through the cable mounting frame.<br>**HINT: Again, It may be easier to connect, or tie-wrap, the coaxes and power cable temporarily.**<br>18. Re-install the cable mounting frame onto cable passage channel using the four screws and flat washers that were removed in step 7 above. . |  |
| 19. Peel layers out of the upper and lower Roxtec® Multidiameter® blocks to provide an opening in the block that is just smaller than the outer diameter of the cable that will pass through it. When compressed the block should provide clamping force on the cable and prevent it from moving in the block. | |

| | |
|---|---|
| 20. Two cables may be passed through each of the Roxtec® Multidiameter® CM-20w40 blocks provided.<br>21. If cables larger than 1.65cm/0.65in outer diameter will be used, larger single-cable Roxtec® Multidiameter CM-40 10-32 blocks are available to allow three cables of up to3.25cm/1.28in diameter to be used. The **rubber bar** and the **three double-cable** Roxtec® Multidiameter blocks will be **replaced** by the **three larger Roxtec® Multidiameter blocks**. |  |
| **HINT: It may be helpful to put the clamp bar and rubber bar in place (held loosely by one screw) to hold some of the Roxtec® Multidiameter blocks in place while you complete the others.** |  |
| 22. Re-install the clamp bar using the hardware removed in step 14 above.<br>23. Remove the tag lines.<br>24. Remove the lifting sling.<br>25. Remove the 4 lifting eye nuts and re-install the original perimeter bolt hardware (the eyes are galvanized with bare thread that will rust if left exposed to the weather). Save the lifting eye hardware in case lifting of the ADE is required in the future. |  |

## *3.4. Grounding the Pedestal*

The antenna pedestal must be grounded to the hull of the ship. A grounding point is provided on the upper base plate to ground the pedestal. You must provide a cable, or strap, that is of sufficient gauge and length to ground the pedestal to the nearest grounding point of the hull (this is usually on or near the mounting surface).

**Solid strap** is the conductor of choice for low impedance RF ground connections because the RF currents tend to flow along the outer surface and the strap has a large, smooth, surface area to take full advantage of this effect.

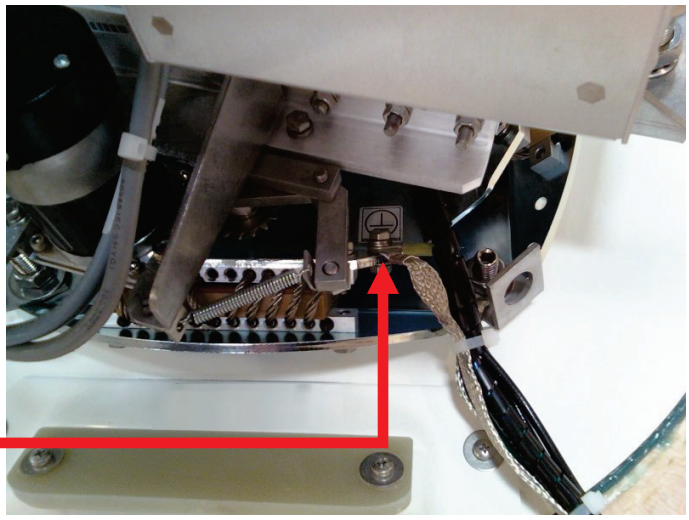
**Braid** is the conductor of choice where flexibility is required. Sea Tel uses braid to cross axes of the antenna pedestal and to connect various subassemblies together.

**Wire** is the easiest to install, the easiest to connect and is readily available with a weather protective jacket. 4 awg and 6 awg bare solid copper wire is commonly used as safety grounds and very basic lightning protection grounds. 2 awg stranded wire is often used for lightning grounding and bonding and it much more flexible.

1. Provide a grounding strap/cable (of adequate gauge for the length) to provide a good ground drain for the antenna pedestal. This cable/strap must also be insulated where it may be exposed to weather.

**NOTE**: **Minimum** gauge should not be smaller than **10 AWG**, even for a short cable run.

2. Route the ground cable/strap into the radome with the coax and power cables.
3. Connect grounding strap/cable to the burnished ground point on the upper base plate.
4. Route the ground strap/cable through one of the Roxtec® Multidiameter® blocks with the other power and coax cables.

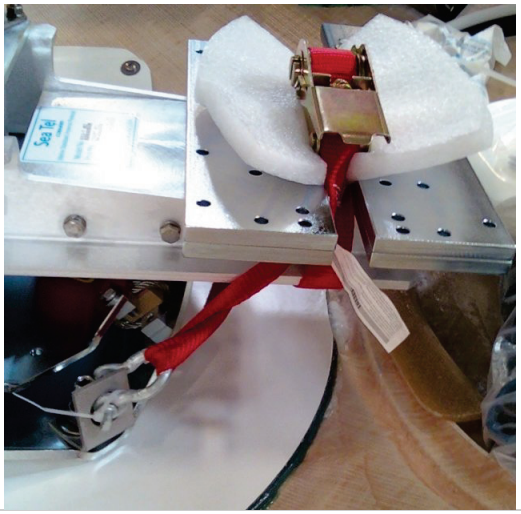


5. Connect the other end of the grounding strap/cable to a burnished ground point on, or near, the mounting surface. Bi-metal coupling plate may be required to get good electrical coupling. Protective coating should be applied to prevent the grounding point from rusting or corroding.

## *3.5. Removing the shipping/Stow restraints*

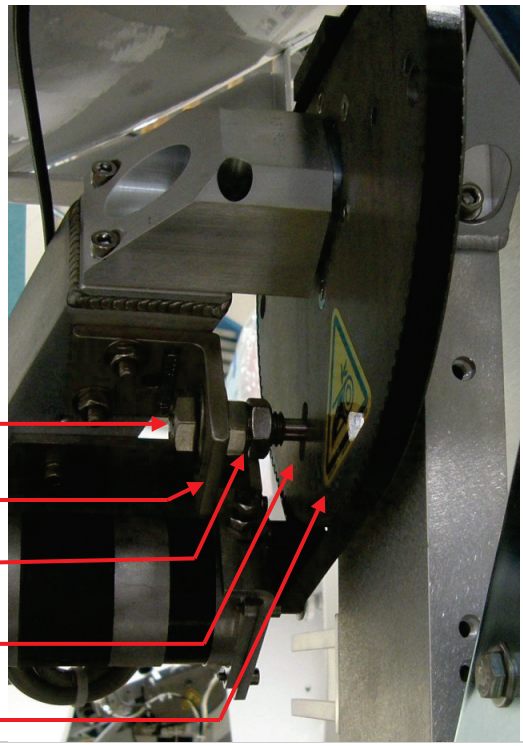
### 3.5.1. Removing the AZ Shipping/Stow Restraint

1. The AZ Shipping/Stow restraint is formed by a buckle web strap wound around the azimuth post toe weight and passed through stow clips in the base of the radome.
2. To un-restrain azimuth rotation of the antenna simply untie/unbuckle the web strap and remove it from the azimuth post and clips.
3. Save the web strap so that the antenna can be restrained in the future should it be required.
4. Verify that the antenna rotates freely and easily a full 360 degrees CW & CCW in Azimuth.

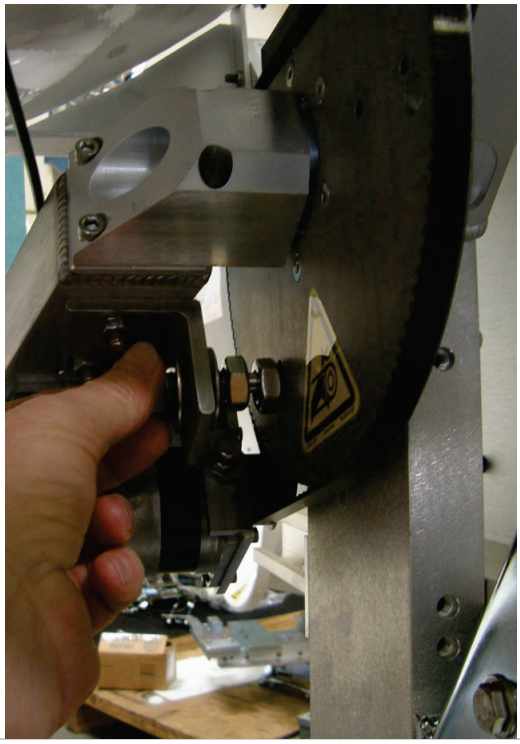


### 3.5.2. Removing the EL Shipping/Stow Restraint

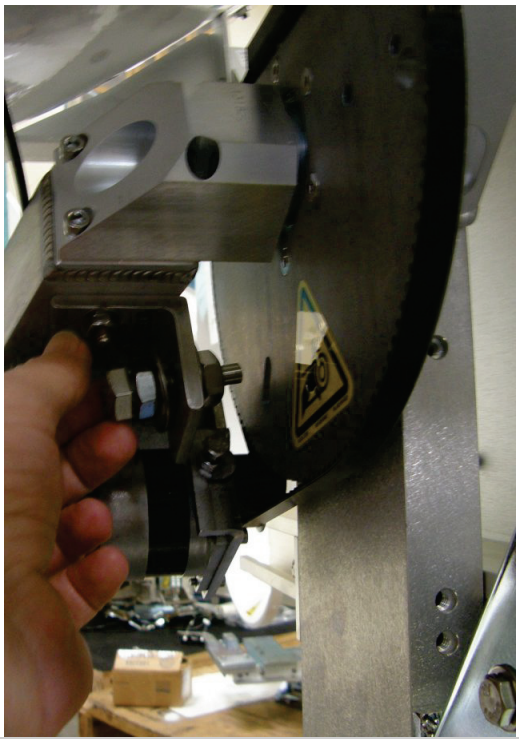
1. The EL Shipping/Stow restraint is formed by a Stow pin-bolt mounted through a bracket and is engaged into a hole/slot in the elevation driven sprocket when the dish is at zenith (90 degrees elevation).
2. In the stowed position the hardware from left to right is Stow pin-bolt head, washer, bracket, washer, hex nut, hex nut so that the pin section of the Stow pin-bolt is inserted into the hole in the elevation driven sprocket.



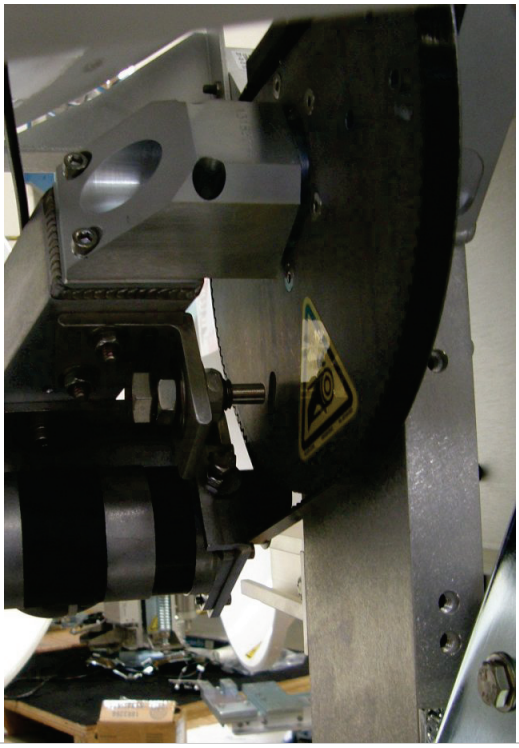

3. To un-restrain the elevation axis of the antenna, unthread the two hex nuts. Using a ¾" open end wrench, remove the hex nuts and washer from the stow pin-bolt.
4. Remove the stow pin-bolt from the bracket.



5. Remove the washer from the stow pin-bolt and thread one of the 2 hex nuts onto the bolt and tighten.
6. Put one of the washers onto the stow pin-bolt and insert it into the bracket toward the elevation driven sprocket.
7. Put the other washer, and then the other hex nut onto the bolt.



8. Tighten the hex nut to prevent the hardware from loosening while in the un-stowed configuration.
9. Verify that the antenna rotates freely through its full elevation range of motion.



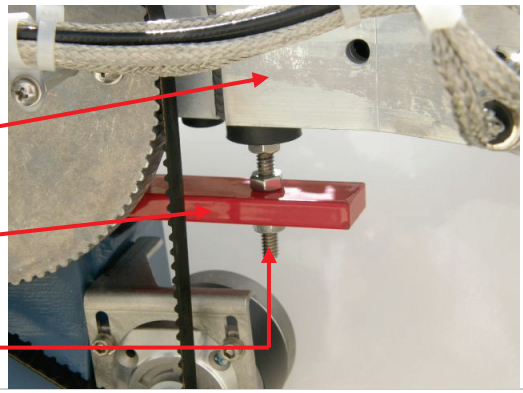
### 3.5.3. Removing the CL Shipping/Stow Restraint

1. The CL Shipping/Stow restraint is formed by a red locking bar with adjustable bumpers at each end of the bar. This mechanism is placed under the cross-level beam to lock it in place.

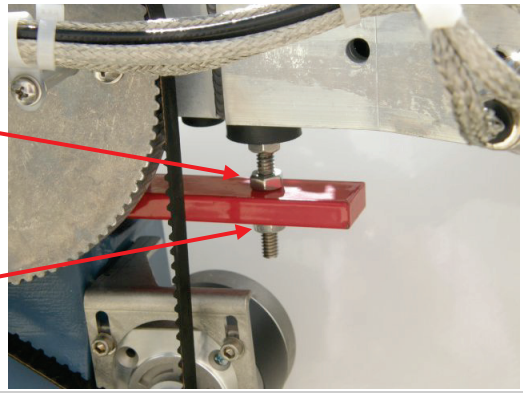
Cross-Level Beam

CL Shipping/Stow bar

Adjustable CL Locking Bumpers (only one end shown)



2. To un-restrain the cross-level axis of the antenna use a 7/16" open end wrench to loosen the nut on the top side of the locking bar (either end of the bar).
3. Remove the bottom nut off of that adjustable bumper.
4. Remove the adjustable bumper from the locking bar.



5. Extract the locking bar from the underside of the cross-level beam and retain these parts for later re-use if it becomes necessary to stow the antenna.
6. Verify that the antenna rotates (tilts left & right from level) freely through its full cross-level range of motion.

## *3.6. Installing the Below Decks Equipment.*

### 3.6.1. General Cautions & Warnings

***CAUTION – Electrical Shock Potentials exist on the Gyro Compass output lines.*** *Assure that the Gyro Compass output is turned* ***OFF*** *when handling and connecting wiring to the Terminal Mounting Strip.*

***CAUTION*** *– Allow only an* ***authorized dealer*** *to install or service the your Sea Tel System components. Unauthorized installation or service can be dangerous and may invalidate the warranty.*

### 3.6.2. Preparing BDE Location

Prepare the Rack (or other location) for the ACU, Terminal Mounting Strip and base multiplexer panel. Prepare the mounting locations for the other Below Decks Equipment throughout ship.

### 3.6.3. System Configuration

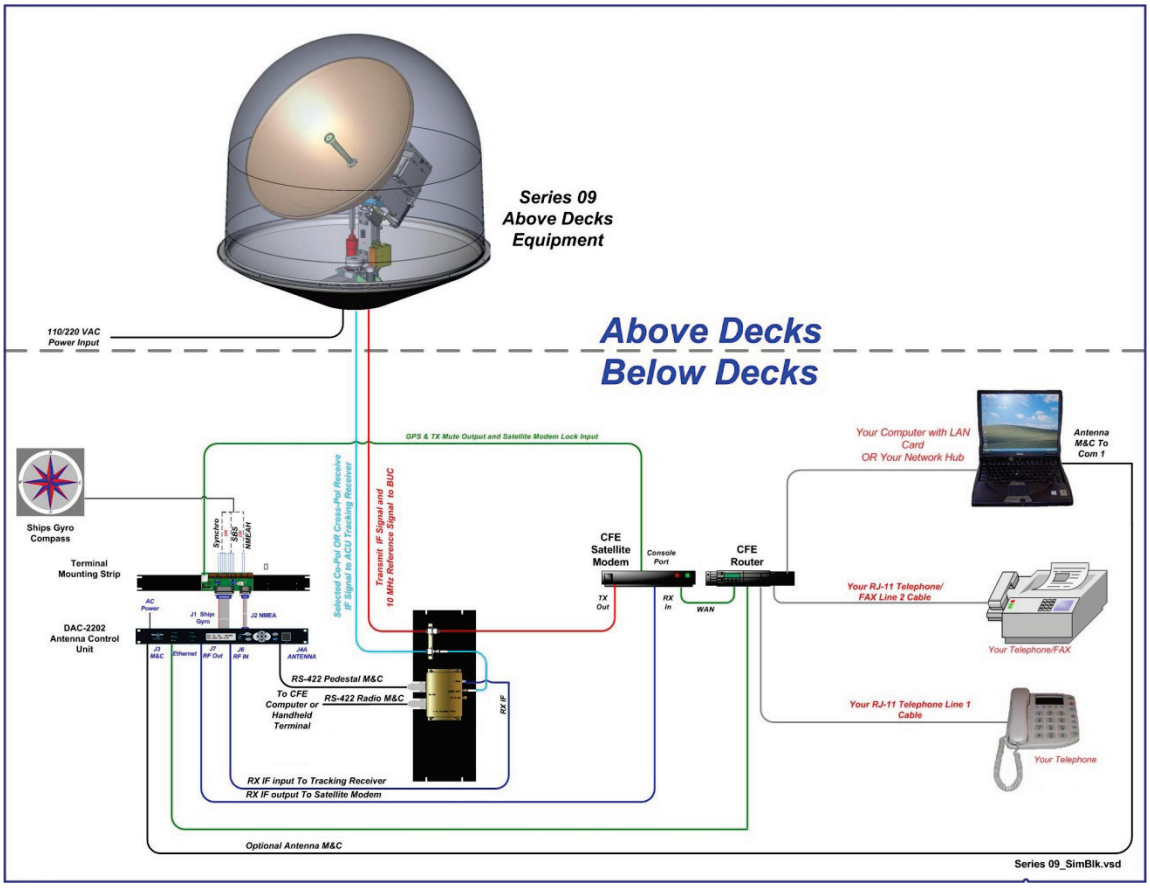



**Figure 3-1 Series 09 Simplified Block Diagram**

### 3.6.4. Installing the Below Deck Equipment

1. Install the ACU in the front of the standard 19" equipment rack or other suitable location. The DAC-2202 ACU is one rack unit high.
2. Install the Terminal Mounting Strip on the rear of the 19" equipment rack or other suitable location that is within 6 feet of the rear panel connections of the ACU. It also is one rack unit height.
3. Install the Base Multiplexer Panel on the rear of the 19" equipment rack or other suitable location that is within 6 feet of the rear panel connections of the ACU. It is four rack unit height.
4. Install your Satellite Modem, Router, VOIP adapters, Telephone equipment, Fax machine, Computers and any other below decks equipment that are part of your installation.

## *3.7. Connecting the Below Decks Equipment*

Connect this equipment as shown in the System Block Diagram. Install the equipment in a standard 19 inch equipment rack or other suitable location. Optional slide rails are available.

### 3.7.1. Connecting the ADE AC Power Cable

Connect the AC Power cable that supplies power to the ADE to a suitably rated breaker or UPS.

### 3.7.2. Connecting the BDE AC Power Cables

Connect the AC Power cables that supply power to the Below Decks Equipment (ACU, Satellite Modem, phone, fax, computer and all other equipment) to an outlet strip fed from a suitably rated breaker or UPS.

### 3.7.3. Connecting the ADE IF Coaxes

1. Attach the TXIF coax from the antenna to the TX Connector on the Base Multiplexer Panel.
2. Attach the RXIF coax from the antenna to the RX Connector on the Base Multiplexer Panel.

### 3.7.4. Connect the Modem TXIF Coax

Connect the TXIF coax from the Base Multiplexer Panel to the Satellite Modem TX Output.

### 3.7.5. Antenna Control Unit Connections

**Figure 1-2 Rear Panel DAC-2202 ACU**

#### *3.7.5.1. Antenna Control Serial Cable*

Connected the Antenna Control Serial Cable from the Base Multiplexer to J4A on the DAC-2202.

#### *3.7.5.2. ACU to Terminal Mounting Strip Connections*

Connect the TMS to the ACU.

1. Connect the 25 pin ribbon cable from the Terminal Mounting Strip to J1 "Ships Gyro" DB25 on the rear panel of the ACU.
2. Connect the 9 pin ribbon cable (or NMEA serial cable) from the Terminal Mounting Strip to J2 "NMEA" DB9 on the rear panel of the ACU

#### *3.7.5.3. RXIF Signal Input to the ACU*

Connect the RXIF cable from the Base Multiplexer to the J6 "RF IN" connector on the rear of the ACU. This input provides satellite signal to the tracking receiver inside the Antenna Control Unit.

#### *3.7.5.4. RXIF to the Satellite Modem*

Connect J7 "RF OUT" on the rear panel of the ACU to the RX Input connector on the Satellite Modem. The RX signal level of the J7 output of the ACU is approximately unity with J6 input due to an in internal amplifier.

#### *3.7.5.5. Ethernet Connection to the ACU*

The Ethernet connection can be used to Monitor & Control the antenna through Antenna Control Unit via the internal web pages, by use of DacRemP IP or via an Ethernet connection through a router/switch/hub to an Open AMIP compatible satellite modem. Use an Ethernet patch cable to make your desired connection to the Ethernet connector on the rear panel of the ACU.

#### *3.7.5.6. M&C Connection to the ACU*

If you wish to use a computer to Monitor & Control the antenna through the Antenna Control Unit there are two possible connections that can be made. One choice is a serial connection from J3 "M&C" connector on the rear panel of the ACU to a COM port on the computer using a serial extension cable. Another choice is to connect the "ETHERNET" connector on the rear panel of the ACU to a LAN connection on the computer or hub using an Ethernet crossover cable.

### 3.7.6. Radio Control Serial Cable

If desired, connected the Radio Control Serial Cable from the Base Multiplexer to the COM Port of a Customer Furnished Computer.

### 3.7.7. Terminal Mounting Strip (TMS) Connections

Connect the Ships Gyro Compass input to the appropriate screw terminals on this strip. The satellite modem must also be connected to provide compliance with FCC Order 04-286 and WRC-03 Resolution 902.

There are several functional connections that may be made on the TMS connectors. Although you may not need to make all of these connections, they are listed here for clarification during the installation process.

Connect the 9 pin ribbon cable from this PCB to J2 "NMEA" DB9 on the rear panel of the ACU. Connect the 25 pin ribbon cable from this PCB to J1 "Ship Gyro" DB25 on the rear panel of the ACU.

***CAUTION - Electrical Shock Potentials exist on the Gyro Compass output lines. Assure that the Gyro Compass output is turned OFF when handling and connecting wiring to the Terminal Mounting Strip. DO NOT HOTPLUG THIS CONNECTION***

#### *3.7.7.1. Jumper Selection*

JP1 – JP4 are used to couple in pull-up resistors for the below listed functions. JP5 selects the DC voltage output on TS4.

**JP1 SW1** – This output would be used for below decks Band Select - to control a band selection switch or tone generator. **Default is OPEN**.

Shorted provides DC Voltage output (determined by JP5 setting) on the SW1 screw terminal to supply voltage to a tone generator or band select switch.

Open provides continuity output (short to ground or open circuit) on the SW1 screw terminal to control devices which have their own power source.

**JP2 SW2** (blockage & RF radiation hazard output) - Provides TX Mute control to the Satellite Modem for FCC compliance in all VSAT systems. It is also used to control antenna switching via a dual antenna arbitrator in dual antenna configurations. **Default is SHORTED** when blocked. The Blocked/Unblocked logic state can be reversed by including SYSTEM TYPE 0016.

Shorted provides DC Voltage output (determined by JP5 setting) on the SW2 screw terminal to supply voltage to the satellite modem when the modem requires DC Voltage to Mute transmission. In dual antenna configurations this used for dual antenna arbitrators that require DC Voltage to switch. This hardware connection is also routed to the Console and OBM RJ45 ports.

Open provides continuity output (short to ground or open circuit) on the SW2 screw terminal to satellite modem when the modem requires continuity control (short or open) to Mute transmission. In dual antenna configurations this used for dual antenna arbitrators that require continuity control (short or open) to switch. This hardware connection is also routed to the Console and OBM RJ45 ports.

**JP3 SW3** (reserved) - Reserved for future use. **Default is OPEN**.

**JP4 AGC** (external AGC input) - Input from Satellite Modem which is used to provide a positive satellite Network Lock (RX Sync) ID when the modem is on the correct network. **Default is SHORTED**. The Locked/Unlocked logic state can be reversed by including SYSTEM TYPE 0128.

Shorted provides a pull-up DC Voltage input (determined by JP5 setting) into the ACU when the modem supplies a continuity output. This hardware connection is also routed to the Console and OBM RJ45 ports.

Open provides a DC Voltage directly from the modem into the ACU when the modem supplies a DC Voltage output. This hardware connection is also routed to the Console and OBM RJ45 ports.

**JP5** Voltage Output Select - Select 12VDC or 24VDC. **Default is 12VDC**.

**JP6** GPS NMEA Output Select - **Default is SHORTED**.

Shorted provides GPS latitude & longitude, in alternating GGA & GLL formatted messages, to be outputted on the Terminal Mounting Strip NMEA output terminals. This hardware connection is also routed to the Console and OBM RJ45 ports.

Open disconnects the GPS output from the Terminal Mounting Strip NMEA output terminals.

#### *3.7.7.2. J1 "Modem Console Port" connector*

FCC compliance connection to an iDirect Satellite Modem can be made very easily by connecting a Straight Serial RJ-45 cable from the J1 "Modem Console Port" connector on the Terminal Mounting Strip to the Console port on the iDirect Modem. Your modem must be set

If your modem is Open AMIP compatible and you wish to use it in an Open AMIP configuration you will use an Ethernet patch or cross-over cable as is appropriate to connect to your LAN.

Refer to the Setup – Modem Connections, Setup and Test chapter for more information.

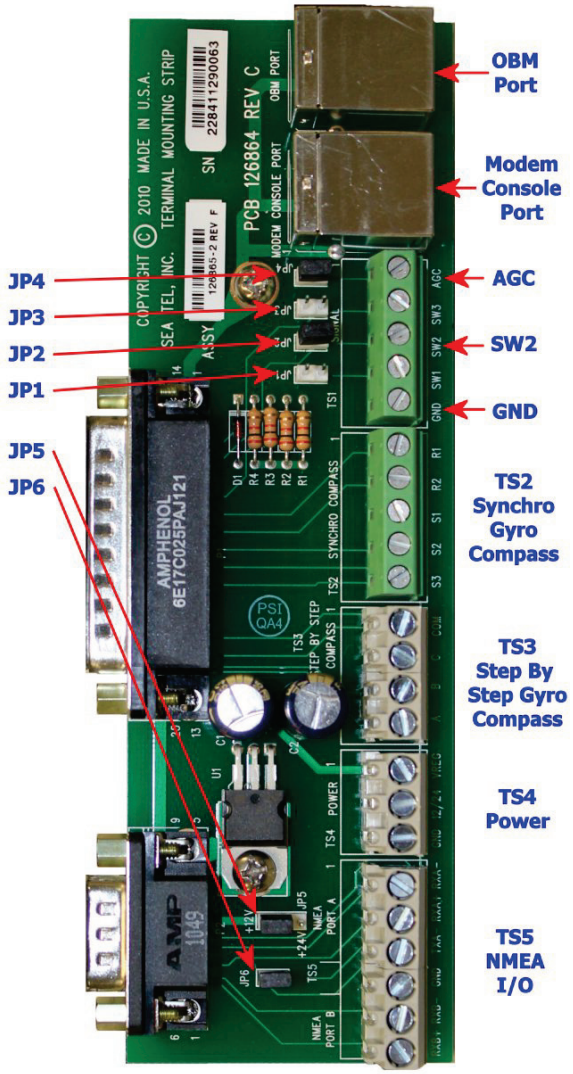
### *3.7.7.3. J2 "OBM Port"*

The Out of Band Management port is used to connect the ACU to the out of band management device, through the Terminal Mounting Strip. This port is also a straight Serial RJ-45 port.

### *3.7.7.4. TS1 Control Interface Connections.*

**AGC & GND** - External AGC, or Modem Lock, input.

- External AGC input to the DAC-2202 must be 0 to 15 Volts DC analog signal, positive going voltage proportional to satellite signal input level and must be real-time in its response to antenna pointing.
- External Modem Lock from a satellite modem is used as a positive ID that the antenna is on the desired satellite. **This input is NOT used for Tracking purposes**, it is only used for satellite identification to acquire the correct satellite during search. To enable the external modem input you must include a 2 in the SYSTEM TYPE parameter (If your system type is presently 76 or 77, then change it to 78 or 79) and **NID MUST be set to 0000**.
- **Connections** - The modem lock signal connects to EXT AGC and a GND reference from the modem. The expected signal from the modem allows 0VDC to +15VDC. Low voltage indicates modem lock, high voltage indicates modem unlock.
- **Testing** - The input connections from the modem can be tested by selecting the external AGC input and monitoring the displayed value. To select external AGC, set the tuning frequency to 0000. Normally, AGC readings below 2048 are considered a low condition and indicate modem lock and AGC readings above 2048 are considered a high condition and indicate modem unlock.




***[If you find the AGC reading for locked and unlocked conditions need to be reversed you must add 128 to your current SYSTEM TYPE parameter]***.

Turn tracking OFF when checking the external AGC inputs. Be sure to properly retune the receiver frequency when you are finished testing the external input.

- **Operation** - In *NORMAL* operation, AGC must be above Threshold AND external MODEM Lock input must be locked to Track the satellite. If you are tracking a satellite signal and the AGC is above threshold (Tracking light on solid) but the external AGC signal rises above 2.5 volts for more than 20 seconds (external MODEM input ***UNLOCKED***) the ACU will automatically retarget the selected satellite.

***SW1*** - ***Band Selection control output***. This output is used to control below decks tone generator(s), or coax switch(s), for band selection functions. The band selection control output is driven by the band selected in the MODE – TRACKING display.

***SW2*** - The ***Blockage/TX Mute*** Control output is driven by Blockage and RF Radiation Hazard functions. This output will short to ground whenever the antenna is within the programmed AZ LIMIT zone(s) or is Searching, Targeting or is mispointed 0.5 degrees from satellite peak. This output is commonly used to drive:

**If your modem cannot use the Modem Console Port connection you will have to provide a transmit inhibit output from the ACU by connecting a SW2 wire connection to the modem to comply with FCC Order 04-286 and WRC-03 Resolution 902**.

- Dual or Quad Antenna Arbitrator coax switches in dual antenna configurations. The coax switches select which antenna is feeding signal to the below decks equipment.
- Mute the Transmit output of the Satellite Modem used in TX/RX antenna configurations when the antenna is positioned where people may be harmed by the transmit power emanating from the antenna (RF Radiation Hazard).
- Mute the Transmit output of the Satellite Modem used in TX/RX antenna configurations when the antenna is mispointed by 0.5 degrees, or more, and keep it muted until the antenna has been within 0.2 degrees of peak pointing to the satellite for a minimum of 5 seconds (FCC part 25.221 & 25.222 TX Mute requirement).

#### *3.7.7.5. TS2 Synchro Gyro Compass Input.*

Use the R1, R2, S1,S2 and S3 screw terminals to connect the Synchro Gyro Compass to the ACU.

#### *3.7.7.6. TS3 Step-By-Step (SBS) Gyrocompass Input.*

Use the COM, A, B and C screw terminals to connect the SBS Gyrocompass to the ACU. Some SBS Gyro distribution boxes have terminals which are labeled S1, S2 & S3 instead of A, B and C.

#### *3.7.7.7. TS4 Power*

- **VREG** Screw terminal is used to provide a regulated DC operating voltage to ancillary equipment. Voltage out is dependant upon which terminal mounting strip assembly is provided. 126865-1 supplies 8Vdc @ 1Amp, while the 126865-2 assembly supplies 5Vdc @ 2Amps.
- **GND** Screw terminal is the ground reference for the regulated and unregulated power terminals.
- **12/24** Screw terminal is commonly used to provide operating voltage to a external GPS, Dual Antenna Arbitrator or other below decks tone generators or switches. Voltage output is based on the T.M.S assemblies JP5 jumper settings.

#### *3.7.7.8. TS5 NMEA A/B, GPS output.*

- ***RxA- and RxA+-*** screw terminals, which are defined as the NMEA A connection is used to connect to the ships Gyro Compass (Heading). The NMEA0183 compliant inputs are then connected via a 9 pin ribbon cable to the ACU's J2 NMEA communications port. A GPS (Latitude and Longitude) input may also be connected, but is not required because there is a GPS device already installed in your antenna.. **NOTE**: *If you connect a ships GPS to the terminal mounting strip, you **MUST** disconnect the GPS antenna on the antenna pedestal.*
- ***RxB- and RxB+*** screw terminals, which are defined as the NMEA B connection is used to connect to the ships Gyro Compass (Heading). The NMEA0183 compliant inputs are then connected via a 9 pin ribbon cable to the ACU's J2 NMEA communications port. A GPS (Latitude and Longitude) input may also be connected, but is not required because there is a GPS device already installed in your antenna.
- ***TxA-*** screw terminal is used to provide a Pseudo GPS (GGA and GLL formats) output to other system components such as a Satellite Modem.

### 3.7.8. Other BDE connections

Connect your other Below Decks Equipment (ie, telephone, fax machine and computer equipment) to complete your configuration.

## *3.8.Final Checks*

### 3.8.1. Visual/Electrical inspection

Do a visual inspection of your work to assure that everything is connected properly and all cables/wires are secured.

### 3.8.2. Electrical - Double check wiring connections

Double check all your connections to assure that it is safe to energize the equipment.

## *3.9. Power-Up*

***Verify that all shipping straps and restrains have been removed prior to energizing the antenna.***

When all equipment has been installed, turn ACU Power and Antenna power ON. The ACU will initially sequentially display:

"SEA TEL – MASTER and DAC-2202 VER 6.xx" followed by,

"SEA TEL – RCVR and SCPC VER 5.xx" followed by,

"SEA TEL – IO MOD and COMMIF VER 1.xx" followed by,

"SEA TEL – REMOTE and INITIALIZING". After initialization, the bottom line of the remote display will display the antenna model number and the software version from the PCU.

Energize and check the other Below Decks Equipment to verify that all the equipment is operating. You will need to assure that the ACU is setup correctly and that the antenna acquires the correct satellite before you will be able to completely check all the below decks equipment for proper operation.

## *3.10. Antenna Maintenance*

### 3.10.1. Balancing the Antenna

The antenna and equipment frame are balanced at the factory however, after disassembly for shipping or maintenance, balance adjustment may be necessary. The elevation and cross-level motors have a brake mechanism built into them, therefore, ***power*** must be ON to release the brakes and **DishScan®** ***and antenna drive*** must be OFF to balance the antenna. . ***Do NOT remove any of the drive belts***. Balancing is accomplished by adding or removing balance trim weights at strategic locations to keep the antenna from falling forward/backward or side to side. The antenna system is not pendulous so 'balanced' is defined as the antenna remaining at rest when left in any position.

The "REMOTE BALANCE" parameter (located at the end of the Remote Parameters after REMOTE TILT) of the ACU. When enabled, Remote Balance Mode temporarily turns DishScan, Azimuth, Elevation and Cross-Level drive OFF. This function is required when trying to balance antenna systems that have a built-in brakes on the elevation and cross-level motors.

***Assure that Antenna power is ON and that the antenna has completed initialization.***

***At the ACU:***

1. From the ACU - REMOTE BALANCE parameter: Enable balance mode (refer to your ACU manual). The screen should now display "REMOTE BALANCE ON".

***At the Antenna:***

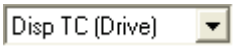
2. At the Antenna: Balance the antenna with the elevation near horizon (referred to as front to back balance) **by adding**, **or subtracting**, **small counter-weights**.
3. Then balance Cross Level axis (referred to as left-right balance) **by moving existing counter-weights from the left to the right or from the right to the left**. Always move weight from one location on the equipment frame to the same location on the opposite side of the equipment frame (ie from the top left of the reflector mounting frame to the top right of the reflector mounting frame). Do NOT add counter-weight during this step.
4. Last, balance the antenna with the elevation pointed at, or near, zenith (referred to as top to bottom balance) **by moving existing counter-weights from the top to the bottom or from the bottom to the top**. Always move weight from one location on the equipment frame to the same location on the opposite side of the equipment frame (ie from the top left of the reflector mounting frame to the bottom left of the reflector mounting frame). Do NOT add counter-weight

during this step.

5. When completed, the antenna will stay at any position it is pointed in for at least 5 minutes (with no ship motion).
6. ***Do NOT cycle antenna power to re-Initialize the antenna***. Return to the ACU, which is still in REMOTE BALANCE mode, and press ENTER to exit Remote Balance Mode. When you exit Balance Mode the antenna will be re-initialized, which turns DishScan®, Azimuth, Elevation and Cross-Level drive ON.

### 3.10.2. Fine Balance and Monitoring Motor Drive Torque

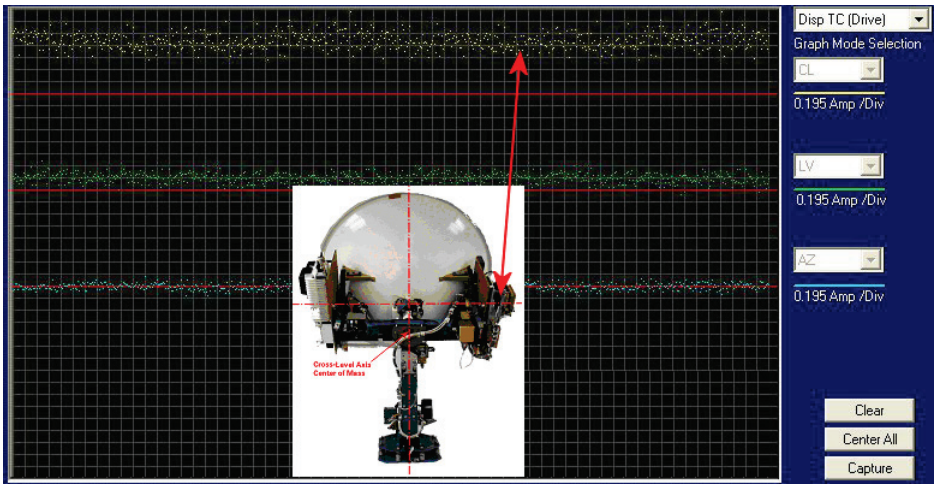
The DacRemP **DISPTC** graph chart provides a means for monitoring torque commands required for each motor for diagnostic purposes and verifying antenna balance. By observing each trace, the required drive of the antenna via the motor driver PCB may be established.

- To view the Torque Commands, select the 

graph chart.
- This chart displays the Torque Command errors for each axis via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 0.195 amps/vertical division.
- In all axes, tracing centered on the reference line means that that axis drive is neutral. Tracing **above** the reference line means that that axis is being driven CCW. Tracing **below** the reference line means that that axis is driving CW.
- A normal trace display will be ± 1 divisions from the red reference line while under calm sea conditions and with DishScan® Drive turned off, as shown below.

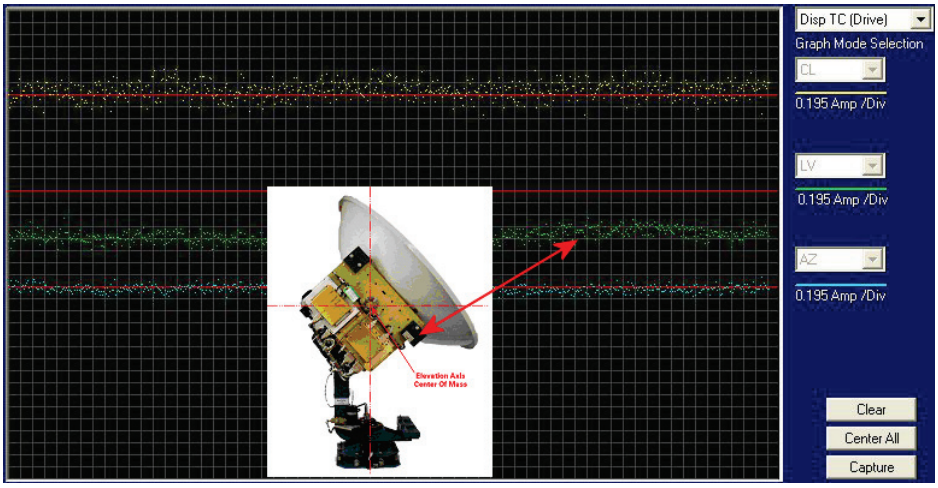
- The Cross Level displayed above the reference line indicates that the CL axis is being driven CCW (Left in CL).

  Example: The antenna pictured in the screen capture below is imbalanced so that it is "Right Heavy". The CL trace is plotting above the red reference line, indicating that CCW drive is required to keep the Cross-Level beam level to the horizon.




- The Level display will plot below the reference line when the antenna requires CW drive (Up in elevation).

  Example: The antenna pictured in the screen capture below is imbalanced so that it is "Front, or Bottom, Heavy". The LV trace is plotting above the red line, indicating that the LV axis is being driven CW to maintain the current elevation position.




- The Azimuth display plots below the red line as the antenna is driven CW and plots above the red line as the antenna is driving CCW.

# 4. Basic Setup of the ACU

## *4.1. Operator Settings*

Refer to the Operation chapter of this manual to set the Ship information. Latitude and Longitude should automatically update when the GPS engine mounted on the antenna pedestal triangulates an accurate location, but you may enter this information manually to begin. Except when integrating NMEA-0183 Gyro source, you will have to enter the initial Heading of the ship, subsequently the ACU will then increment/decrement as the Gyro Compass updates.

Next, set the Satellite information. Longitude of the desired satellite you wish to use and the receiver settings for it are especially important.

At this point you should be able to target the desired satellite. Continue with the setup steps below to optimize the parameters for your installation.

## *4.2. SETUP Parameter display and entry menus.*

***Press and hold*** BOTH the LEFT and the RIGHT arrow keys ***for 6 seconds*** to access to the system setup parameters (at the ***EL TRIM*** selection). **Press** BOTH the LEFT and the RIGHT arrow keys **momentarily** to access to the **SAVE NEW PARAMETERS** parameter.

Access is only required after installation or repairs of your antenna system. These parameters should only be changed by an authorized service technician.

**CAUTION**: Improper setting of these parameters will cause your system to not perform properly. Also refer to the SETUP section of your Antenna manual.

## *4.3. Default Setup Parameters for your Antenna*

The following table shows the factory default parameters for the DAC-2202 Antenna Control Unit interfaced to a Series 09 Antenna PCU. When you receive the system it will have factory default settings in the ACU. After installation of the system, some of the settings will remain at factory default and others should be optimized for specific applications.

| PARAMETER | 4009 | 5009 | 6009 | Optimize using Lesson |
|---|---|---|---|---|
| AUTO TRIM | | | | Setup – Targeting |
| EL TRIM | 0 | | | |
| AZ TRIM | 0 | | | |
| AUTO THRES | 100 | | | |
| EL STEP SIZE | 0 | | | Leave at factory Defaults |
| AZ STEP SIZE | 0 | | | |
| STEP INTEGRAL | 0 | | | |
| SEARCH INC | 15 | | | Setup - Searching |
| SEARCH LIMIT | 100 | | | |
| SEARCH DELAY | 30 | | | |
| SWEEP INC | 47 | | | |
| SYSTEM TYPE | 23 * | | | Setup – Modem Connect, Setup and Test |
| GYRO TYPE | 2 (NMEA/SBS) | | | Setup – Ships Gyro Compass |

| | | |
|---|---|---|
| POL TYPE | 72 | Setup – Optimizing Polarity & Cross Pol Isolation |
| POL OFFSET | 40 | |
| POL SCALE | 90 | |
| AZ LIMIT 1 | 0 | Setup – Blockage & RF Radiation Hazard Zones |
| AZ LIMIT 2 | 0 | |
| EL LIMIT 12 | 90 | |
| AZ LIMIT 3 | 0 | |
| AZ LIMIT 4 | 0 | |
| EL LIMIT 34 | 90 | |
| AZ LIMIT 5 | 0 | |
| AZ LIMIT 6 | 0 | |
| EL LIMIT 56 | 90 | |
| 5v OFFSET | 0 | Leave at factory Defaults |
| 5V SCALE | 0 | Leave at factory Defaults |
| TX POLARITY | 2 (Horizontal TX) | Setup – Optimizing Polarity & Cross Pol Isolation |
| TRACK DISP | 130 or 170 | Setup – Band Selection |

**** This parameter value is for use with iDirect 5000 Series satellite modem to provide Modem Lock input & Modem TX Mute functions. Refer to Setup – Modem Connect, Setup and Test for values for some other common Satellite Modems and other SYSTEM TYPE parameter information.***

| REMOTE PARAMETER | 4009 | 5009 | 6009 | Optimize using Lesson |
|---|---|---|---|---|
| Legacy PCU or MK2 PCU<br>Configuration Number N0xxx<br>DishScan Phase/Gain N7xxx | <br>004<br>026 | <br>005<br>021 | <br>006<br>022 | Leave at factory Defaults |
| MK2 PCU & Codan 8WMini BUC<br>Configuration Number N0xxx<br>DishScan Phase/Gain N7xxx | <br>007<br>026 | <br>009<br>022 | | |
| MK2 PCU & Gilat 4W BUC<br>Configuration Number N0xxx<br>DishScan Phase/Gain N7xxx | <br>002<br>026 | | | |
| Home Flag Offset N6xxx | 000 | | | Setup – Home Flag Offset |

## *4.4. SAVE NEW PARAMETERS*

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access "SAVE NEW PARAMETERS" directly from any other menu display. Verify that the change(s) you have made is/are correct and then select "SAVE NEW PARAMETERS". Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

# 5. Setup – Ships Gyro Compass

The Ships Gyro Compass connection provides true heading (heading of the ship relative to true North) input to the system. This allows the ACU to target the antenna to a "true" Azimuth position to acquire any desired satellite.

After targeting this input keeps the antenna stabilized in Azimuth (keeps it pointed at the targeted satellite Azimuth). In normal operation when viewing and ADMC recording in DacRemP, the "Relative Azimuth" trace should do exactly ***equal & opposite*** to whatever the Heading trace does and the "Azimuth" trace should stay flat.

In normal operation the heading display in the ACU should at all times be the same value as the reading on the Gyro Compass itself (this is also referred to as Gyro Following.).

If the ACU is not Following the Ships Gyro Compass correctly (un-erringly) refer to the Troubleshooting Gyro Compass Problems.

## *5.1. GYRO TYPE*

The GYRO TYPE parameter selects the type of gyro compass interface signal, the appropriate hardware connections and the ratio of the expected input signal for ship turning compensation. Default GYRO TYPE parameter for all systems is 0002 so that the ACU will properly follow for Step-By-Step or NMEA gyro signals.

If the Ships Gyro Compass output is Synchro, or there is NO Gyro Compass, the GYRO TYPE parameter must be set correctly to properly read and follow the Ships Gyro Compass signal that is being provided. The acceptable settings are:

| | |
|---|---|
| 362 | for 360:1 Synchro with S/D Converter |
| 90 | for 90:1 Synchro with S/D Converter |
| 36 | for 36:1 Synchro with S/D Converter |
| 2 | for Step-By-Step gyro or NMEA gyro |
| 1 | for 1:1 Synchro with S/D Converter |
| 0 | for No Gyro linear AZ Search Mode (No Heading input available) |

## *5.2. Updating the GYRO TYPE parameter*

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

When you are finished making parameter changes, go to the SAVE NEW PARAMETERS display to save the changes you have made.

## *5.3. If There is NO Ships Gyro Compass*

Without heading input to the system the ACU will **NOT** be able to target, or stay stabilized **ON**, a "true" azimuth pointing angle. This will make satellite acquisition much more difficult and the true azimuth value that any given satellite should be at will not be displayed correctly.

***This mode of operation is NOT recommended for ships***. A better solution would be to provide a Satellite Compass (multiple GPS Antenna device) to provide true heading input to the ACU. These devices are readily available and are much less expensive than a Gyro Compass.

If there is NO Gyro Compass (ie on a large stationary rig which is anchored to the ocean floor) set the GYRO TYPE parameter to 0000, the SWEEP INC parameter to 0047 and SAT REF (Satellite Reference Mode) ***MUST*** be turned **ON**. This combination of settings will cause "No Gyro" Search pattern to be use to find the desired satellite (refer to the setup – Searching lesson).

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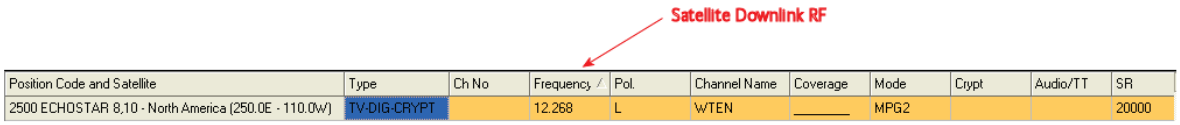
# 6. Setup – Tracking Receiver – VSAT

## 6.1. Determining the IF Tracking Frequency (MHz)

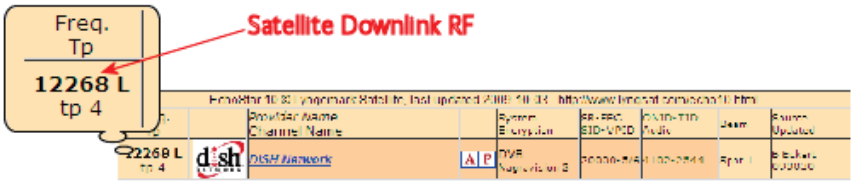
The IF Tracking frequency parameter is a value entered into the ACU's **MHZ** Sub-Menu. The value itself may be provided by your air-time provider and the MHz value will be entered directly in this sub-menu.

Or, the RF downlink frequency of a specific carrier on the desired satellite can be obtained from a satellite website and calculated by using the formula RF- LO = IF. When you take the Satellite Transponder Downlink RF value and subtract the LNB's Local Oscillator (LO) Value, the resultant value will equal the Intermediate Frequency (IF). It is this IF value that will be entered into the ACU for tracking purposes.

Example assuming an LNB LO value of 11.25GHz: 12268.0 MHz – 11250.0 MHz = 1018.0 MHz IF




**Identifying the Downlink RF using SatcoDX**




**Identifying the Downlink RF using Capture from Lyngsat.com**

## 6.2. KHz

The KHz rate entered into the ACU is an absolute value which also may have been provided by your air-time provider, or have been calculated, and is entered directly in this sub-menu window.

In the example above, 1018.0 MHz was calculated (1018 MHz 000 KHz) therefore, the KHz entry would be 000. If the provided/calculated value had been 1018.250, 1018 would have been entered in the MHz window and 250 would be entered in the KHz window.

## 6.3. FEC

### 6.3.1. L-Band SCPC Receiver

The Forward Error Correction rate entered into the ACU should always be set to **SCPC** with an L-Band SCPC receiver card installed in the ACU.

## 6.4. Tone

### 6.4.1. VSAT Application

In VSAT antenna system, there is no need for below decks band selection and thus there is no applicable use for tone control. For VSAT antenna systems that have voltage and tone controlled multiband LNB's installed, you will use the tracking band selection to control/toggle the tone state of a 22 KHz tone generator (installed in the above decks equipment). For detailed information, refer to the "SETUP-Band Select" section of this document.

## *6.5. Volt*

### 6.5.1. VSAT Application

Above Decks Powered - The LNB's installed onto all VSAT antenna systems are powered by the antenna itself (above decks), and thus there is no applicable use for VOLT control. For antenna systems that have voltage and tone controlled multiband LNB's installed, you will use the tracking band selection to control/toggle the voltage output of the ADE 400MHz FSK modem. For detailed information, refer to the "SETUP-Band Select" section of this document.

## *6.6. SAT SKEW*

SKEW is used to optimize the polarization of the feed to the desired satellite signal. In VSAT systems this is normally adjusted during the cross-pol isolation testing with the Network or Satellite Provider (refer to (Optimizing Cross-Pol Isolation).

## *6.7. NID*

In VSAT systems the Network Identification parameter should always be set to 0000 to allow external network lock to be supplied into the ACU from the satellite modem.

# 7. Setup – Band Selection

To properly control the band selection of the LNB(s) mounted on the antenna the TRACK DISP (Tracking Display) parameter ***must*** be set correctly. Which value the TRACK DISP parameter is set to depends on the hardware configuration of the antenna pedestal.

The xx09-17 and xx09-33 antenna pedestals come with the waveguide diplexer and LNB to provide the additional Co-Pol RXIF output to the Cross-Pol/Co-Pol select coax switch (all of the systems come with the switch and coax installed, so you can easily upgrade the antenna with the Co-Pol hardware).

The TRACK DISP parameter controls Tone, Voltage and Aux functions remotely on the antenna pedestal. Voltage and Tone are used to select the desired band of dual-band, tri-band and quad-band LNBs. The Aux function controls the Cross-Pol/Co-Pol select switch.

Sea Tel provides quad-band LNBs as a default LNBs on the 09 Series antennas, therefore, the default TRACK DISP parameter for Cross-Pol only systems is 0170 and 0130 for 09 antennas with Cross-Pol AND Co-Pol LNBs.

## *7.1. Cross-Pol Only Single-Band LNB*

Use Xp 18 when you want Cross-Pol output to be routed to below decks (**use the 18VDC setting to minimize current drawn by the LNB**).

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0040 | Xp 13 | Tone OFF, Volt 13, Aux 0 |
| | Xp 18 | Tone OFF, Volt 18, Aux 0 |
| | Cp 13 | Tone OFF, Volt 13, Aux 1 |
| | Cp 18 | Tone OFF, Volt 18, Aux 1 |

## *7.2. Cross-Pol Only Dual-Band LNB*

Use Xp 13 when you want Cross-Pol low band output to be routed to below decks or use Xp 18 to select Cross-Pol high band.

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0040 | Xp 13 | Tone OFF, Volt 13, Aux 0 |
| | Xp 18 | Tone OFF, Volt 18, Aux 0 |
| | Cp 13 | Tone OFF, Volt 13, Aux 1 |
| | Cp 18 | Tone OFF, Volt 18, Aux 1 |

## *7.3. Cross-Pol Only Tri-Band LNB*

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0190 | KuLo | Tone OFF, Volt 13, Aux 0 |
| | KuMid | Tone ON, Volt 13, Aux 0 |
| | KuHi | Tone OFF, Volt 18, Aux 0 |
| | RxOff | Tone ON, Volt 18, Aux 0 |

## *7.4. Cross-Pol only Quad-Band LNB*

This is the default setting for the Series 09 antenna pedestals with Quad-Band SMW LNB.

Use the Band1 when you want Cross-Pol Band1 output to be routed to below decks, Band 2 selects Cross-Pol Band2, Band 3 selects Cross-Pol Band3 and Band 4 selects Cross-Pol Band4.

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0170 | Band1 | Tone OFF, Volt 13, Aux 0 |
| | Band2 | Tone ON, Volt 13, Aux 0 |
| | Band3 | Tone OFF, Volt 18, Aux 0 |
| | Band4 | Tone ON, Volt 18, Aux 0 |

## *7.5. Cross-Pol AND Co-Pol Single-Band LNBs*

Use Xp 18 when you want Cross-Pol output to be routed to below decks and use Cp 18 when Co-Pol output is desired below decks (**use the 18VDC settings to minimize current drawn by the LNBs**).

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0040 | Xp 13 | Tone OFF, Volt 13, Aux 0 |
| | Xp 18 | Tone OFF, Volt 18, Aux 0 |
| | Cp 13 | Tone OFF, Volt 13, Aux 1 |
| | Cp 18 | Tone OFF, Volt 18, Aux 1 |

## *7.6. Cross-Pol AND Co-Pol Dual-Band LNBs*

Use Xp 13 when you want Cross-Pol low band output to be routed to below decks, Xp 18 selects Cross-Pol high band, Cp13 selects Co-Pol low band and Cp 18 selects Co-Pol high band.

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0040 | Xp 13 | Tone OFF, Volt 13, Aux 0 |
| | Xp 18 | Tone OFF, Volt 18, Aux 0 |
| | Cp 13 | Tone OFF, Volt 13, Aux 1 |
| | Cp 18 | Tone OFF, Volt 18, Aux 1 |

## *7.7. Cross-Pol AND Co-Pol Tri-Band LNBs*

Use the Xp B1 when you want Cross-Pol KuLo band output to be routed to below decks, Xp B2 selects Cross-Pol KuMid band, Xp B3 selects Cross-Pol KuHi band, Xp and B4 selects RxOff. Use the Cp B1 when you want Co-Pol KuLo band output to be routed to below decks, Cp B2 selects Co-Pol KuMid band, Cp B3 selects Co-Pol KuHi band and Cp B4 selects Co-Pol RxOff.

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0130 | Xp B1 | Tone OFF, Volt 13, Aux 0 |
| | Xp B2 | Tone ON, Volt 13, Aux 0 |
| | Xp B3 | Tone OFF, Volt 18, Aux 0 |
| | Xp B4 | Tone ON, Volt 18, Aux 0 |
| | Cp B1 | Tone OFF, Volt 13, Aux 1 |
| | Cp B2 | Tone ON, Volt 13, Aux 1 |
| | Cp B3 | Tone OFF, Volt 18, Aux 1 |
| | Cp B4 | Tone ON, Volt 18, Aux 1 |

## *7.8. Cross-Pol AND Co-Pol Quad-Band LNBs*

This is the default setting for the Series 09 antenna pedestals with Quad-Band SMW LNBs.

Use the Xp B1 when you want Cross-Pol Band1 output to be routed to below decks, Xp B2 selects Cross-Pol Band2, Xp B3 selects Cross-Pol Band3 and Xp B4 selects Cross-Pol Band4. Use the Cp B1 when you want Co-Pol Band1 output to be routed to below decks, Cp B2 selects Co-Pol Band2, Cp B3 selects Co-Pol Band3 and Cp B4 selects Co-Pol Band4.

When you are finished making parameter changes, go to the SAVE NEW PARAMETERS display to save the changes you have made.

| TRACK DISP Setting | Displayed band selection | ADE Band Select Parameters (Tone, Voltage & Aux Status) |
|---|---|---|
| 0130 | Xp B1 | Tone OFF, Volt 13, Aux 0 |
| | Xp B2 | Tone ON, Volt 13, Aux 0 |
| | Xp B3 | Tone OFF, Volt 18, Aux 0 |
| | Xp B4 | Tone ON, Volt 18, Aux 0 |
| | Cp B1 | Tone OFF, Volt 13, Aux 1 |
| | Cp B2 | Tone ON, Volt 13, Aux 1 |
| | Cp B3 | Tone OFF, Volt 18, Aux 1 |
| | Cp B4 | Tone ON, Volt 18, Aux 1 |

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# 8. Setup – Targeting

Optimizing the targeting of the antenna to land on or near a desired satellite (within +/-1 degree) is outlined below.

## *8.1. AUTO TRIM*

The Auto Trim function will automatically calculate and set the required Azimuth and Elevation trim offset parameters required to properly calibrate the antennas display to the mechanical angle of the antenna itself, while peaked ON satellite. It will also calculate, and set, the proper Auto-Threshold value for this system to use on the desired/targeted satellite.

To enable this function, the Antenna MUST be actively tracking the satellite with positive SAT ID and elevation of the antenna must be less than 83 degrees and the ACU must NOT be set for Inclined Orbit Search. After locating the satellite, with Tracking ON, wait at least 30 seconds before performing the AUTO TRIM feature, this will allow sufficient time for the antenna to peak up on signal. It is equally important that you verify that the system is tracking the CORRECT satellite (verify video is produced on the Televisions in a TVRO system or verify a RX lock indication on the satellite modem in a VSAT system).

While in the AUTO TRIM sub-menu, press the **LEFT** arrow key to bring start the calibration procedure, the display should read AUTO TRIM SETUP, press the **ENTER** key to submit. AUTO TRIM SAVED will be displayed, indicating the proper AZ and EL trims were submitted to RAM. This does not save these parameters to NVRAM, in order to save to memory, continue down through the setup mode parameters until the SETUP **SAVE NEW PARAMETERS** sub menu is displayed. Press the **RIGHT** arrow and then press the **ENTER** key. The display should now report that the parameters were saved. From the AUTO TRIM SETUP screen, press the **NEXT** key (DAC2202) without hitting **ENTER** to escape this screen without submitting the new AZ and EL Trim values.

**NOTE**: AUTO TRIM LOCKED will be displayed on the front panel, indicating that the AUTO TRIM Feature is **NOT** allowed if all of these conditions are not met:

The ACU ***must*** be actively tracking a satellite (AGC above threshold) ***and***

The ACU ***must*** have positive SAT ID (internal NID match or external RX lock received from the Satellite Modem) ***and***

The elevation angle of the antenna ***must*** be LESS than 75 degrees ***and***

The ACU ***must*** NOT be set for Inclined Orbit Search.

## *8.2. Manually Optimizing Targeting*

First, assure that all of your Ship & Satellite settings in the ACU are correct.

1. Target the desired satellite, immediately turn Tracking OFF, and record the Azimuth and Elevation positions in the "***ANTENNA***" display of the ACU (these are the **Calculated** positions).
2. Turn Tracking ON, allow the antenna to "Search" for the targeted satellite and assure that it has acquired (and peaks up on) the satellite that you targeted.
3. Allow several minutes for the antenna to "peak" on the signal, and then record the Azimuth and Elevation positions while peaked on satellite (these are the Peak positions). Again, assure that it has acquired the satellite that you targeted!
4. Subtract the Peak Positions from the Calculated Positions to determine the amount of Trim which is required. Refer to the ACU Setup information to key in the required value of Elevation Trim.
5. Continue with Azimuth trim, then re-target the satellite several times to verify that targeting is now driving the antenna to a position that is within +/- 1.0 degrees of where the satellite signal is located.

EXAMPLE: The ACU targets to an Elevation position of 30.0 degrees and an Azimuth position of 180.2 (Calculated), you find that Peak Elevation while ON your desired satellite is 31.5 degrees and Peak Azimuth is 178.0. You would enter an EL TRIM value of –1.5 degrees (displayed as -0015) and an AZ TRIM of +2.2 degrees (displayed as 0022). After these trims values had been set, your peak ***on satellite*** Azimuth and Elevation displays would be very near 180.2 and 30.0 respectively.

## *8.3. EL TRIM*

Elevation trim offset parameter is entered in tenths of degrees. Adjusts display to correct for antenna alignment errors or imbalances in the antenna system. Increase number to increase display. Refer to "Optimizing Targeting" in the Setup section of your antenna manual.

To update: While in the EL TRIM sub-menu, press the LEFT arrow key to bring the cursor under the ones digit. Press the UP or DOWN arrow key to increment or decrement the selected digit. Minus values are entered by decrementing below zero. Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

Continue with Azimuth trim, then re-target the satellite several times to verify that targeting is now driving the antenna to a position that is within +/- 1.0 degrees of where the satellite signal is located.

## *8.4. AZ TRIM*

Azimuth trim offset parameter is entered in tenths of degrees. Offsets true azimuth angle display to compensate for installation alignment errors when used with Ships Gyro Compass input reference. **Azimuth Trim does not affect REL azimuth reading**. Increase number to increase displayed value. Refer to "Optimizing Targeting" in the Setup section of your antenna manual.

To update: While in the AZ TRIM sub-menu, press the LEFT arrow key to bring the cursor under the ones digit. Press the UP or DOWN arrow key to increment or decrement the selected digit. Minus values are entered by decrementing below zero. Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

Then re-target the satellite several times to verify that targeting is now driving the antenna to a position that is within +/- 1.0 degrees of where the satellite signal is located.

# 9. Setup – Home Flag Offset

Home Flag Offset is used to calibrate the relative azimuth value of the antenna to the bow line of the ship. This assures that the encoder input increments/decrements from this initialization value so that the encoder does not have to be precision aligned. When the antenna is pointed in-line with the bow (parallel to the bow) the "Relative" display value should be 000.0 **Relative** (360.0 = 000.0). Good calibration is especially important if blockage mapping is used, because the values entered into the AZ LIMIT parameters are entered in ***Relative*** Azimuth. The default Home Flag Offset value saved in the PCU is 000.

The Home Flag Sensor mounted on the pedestal is actuated by a metal tab mounted on the azimuth spindle which causes it to produce the "Home Flag" signal.

The default mounting of the radome is with its bow reference in-line with the bow and the base hatch in-line with the stern (aft reference of the radome). There are valid reasons for mounting the ADE in a different orientation than the default. One of these would be that the hatch of radome needs to be oriented inboard of the ship for safe entry into the dome (ie ADE is mounted on the Port, or Starboard, edge of the ship and safe entry is only available from inboard deck or inboard mast rungs).

**Observe initialization of the antenna**. When Azimuth drives CW and then stops at "Home" position, VISUALLY compare the antennas pointing, while at Home position, to the bow-line of the ship (parallel to the Bow).

**If it appears to be very close** to being parallel to the bow, you will not need to change the HFO and should proceed with Optimizing Targeting. When "Optimizing Targeting" small variations (up to +/- 5.0 degrees) in Azimuth can be easily corrected using the AZ TRIM parameter.

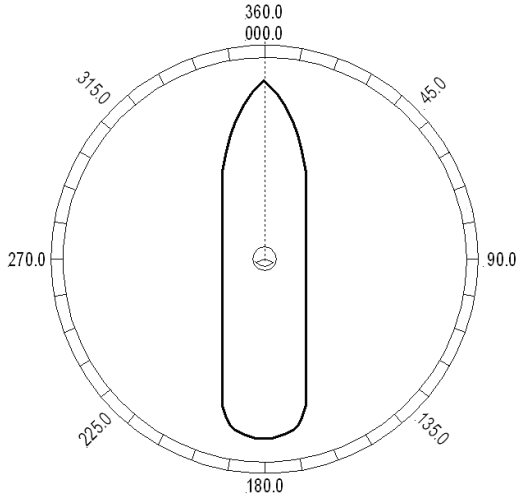



**Figure 9-1 Antenna stops In-line with Bow**

**If it is NOT close** (stops before the bow or continues to drive past the bow) HFO needs to be adjusted.

> ***If the antenna is pointing to the LEFT of the bow line:*** If the antenna stops driving before the bow line, when targeting a satellite it will fall short of the desired satellite by exactly the same number of degrees that it fell short of the bow line. You must calibrate HFO using either of the methods below.
>
> ***If the antenna is pointing to the RIGHT of the bow line:*** If the antenna continues to drive past the bow line, when targeting a satellite it will overshoot the desired satellite by exactly the same number of degrees that it went past the bow line. You must calibrate HFO using either of the methods below.

**If you find that a large value of AZ TRIM** parameter has been used to calibrate the antenna, This indicates that the Relative position is incorrect and should be "calibrated" using the correct HFO value ***instead*** of an Azimuth Trim offset.

If the radome was purposely rotated, has a large value of AZ TRIM or was inaccurately installed (greater than +/- 5 degrees), there are twos way of setting Home Flag to compensate for the mounting error. They are:

## *9.1. Electronic Calibration of Relative Antenna Position (Home Flag Offset)*

Above, you VISUALLY compared the antenna pointing, while at "Home" position, to the bow-line of the ship and found that the antenna pointing was **NOT close** to being parallel to the bow-line. It stopped before the bow or went past the bow **OR** you found **AZ TRIM** has been set to a large value, therefore, ***HFO needs to be adjusted***.

Ascertain the exact amount of error using the appropriate procedure below, enter the HFO to calibrate the antenna to the ship, save the value and re-initialize the antenna to begin using the new value.

### 9.1.1. <u>You Found a Large AZ TRIM value:</u>

If Targeting has been optimized by entering a large value of AZ TRIM; First, verify that you are able to repeatably accurately target a desired satellite (within +/- 1.0 degrees). Then you can use the AZ TRIM value to calculate the value of HFO you should use (so you can set AZ TRIM to zero). AZ Trim is entered as the number of ***tenths*** of degrees. You will have to convert the AZ TRIM value to the nearest **whole** degree (round up or down as needed). Calculated HFO value is also rounded to the nearest whole number.

If AZ TRIM was a **plus** value: HFO = (TRIM / 360) x 255 Example: AZ TRIM was 0200 (plus 20 degrees). HFO = (20/360) x 255 = (0.0556) x 255 = 14.16 round off to 14. Set, and Save, HFO to 014 using the "To Enter the HFO value" procedure below.

If AZ TRIM was a **negative** value: HFO = ((360-TRIM) / 360)) x 255 Example: AZ TRIM = -0450 (minus 45 degrees). HFO = ((360 – 45) / 360)) x 255 = (315 / 360) x 255 = 0.875 x 255 = 223.125 round of to 223. Set, and Save, HFO to 223 using the "To Enter the HFO value" procedure below.

### 9.1.2. You Observe "Home" Pointing is LEFT of the Bow-line:

1. In this example, I observe that the Home position is short of the bow line.
2. I estimate that it is about 45 degrees.
3. I target my desired satellite and record the Calculated Azimuth to be 180.5.
4. I drive UP (I estimated that I will need to go UP about 45 degrees) and finally find my desired satellite.
5. Turn tracking ON to let the ACU peak the signal up. When peaked, the Azimuth is 227.0 degrees.
6. I subtract Calculated from Peak (227 – 0180.5 = 46.5) and difference is 46.5 degrees.
7. I can calculate what the correct value for the Home position of the antenna by subtracting (because "home" was to the left of bow) this difference of 46.5 from the bow line position 360.0. Therefore "home" should be 313.5 Relative.
8. I now calculate the HFO = (313.5 / 360) x 255 = 0.87 x 255 = 222.06 which I round off to 222.
9. I set, and Save, HFO to 222 using the "To Enter the HFO value" procedure below. After I re-initialize the relative position of the antenna is now calibrated.
10. If there is a small amount of error remaining, use AZ TRIM in the Optimizing Targeting procedure to correct it.

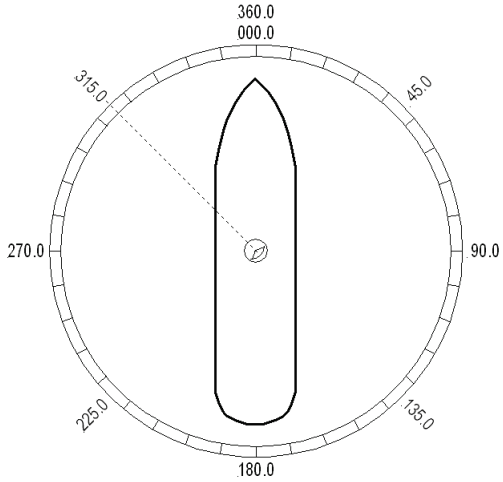



**Figure 9-2 Antenna stopped before the Bow**

### 9.1.3. You Observe "Home" Pointing is RIGHT of the Bow-line:

1. In this example, I observe that the Home position is past the bow line.
2. I estimate that it is about 90 degrees.
3. I target my desired satellite and record the Calculated Azimuth to be 180.0.
4. I drive DOWN (I estimated that I will need to go **DOWN** about 89 degrees) and finally find my desired satellite.
5. Turn tracking ON to let the ACU peak the signal up. When peaked, the Azimuth is 90.0 degrees.
6. I subtract Calculated from Peak (180.0 – 90.0 = 90.0) and difference is 90.0 degrees.
7. I can calculate what the correct value for the Home position of the antenna by **adding** (because

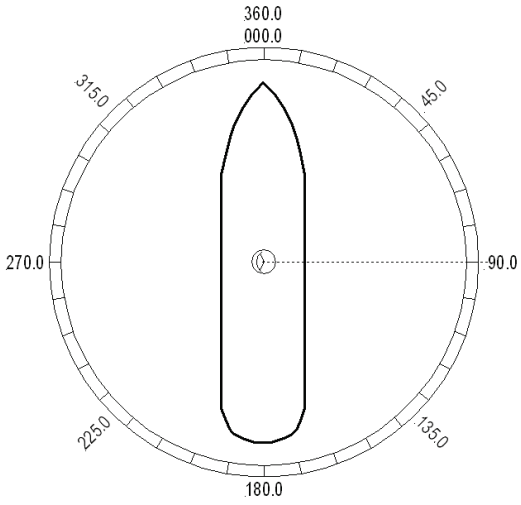



**Figure 9-3 Antenna stops past the Bow**

"home" was to the right of bow) this difference of 09.0 to the bow line position 000.0. Therefore "home" should be 90.0 Relative.

8. I now calculate the HFO = = ((90.0) / 360)) x 255 = 0.25 x 255 = 63.75 which I round off to 64.
9. I set, and Save, HFO to 222 using the "To Enter the HFO value" procedure below. After I re-initialize the relative position of the antenna is now calibrated.
10. If there is a small amount of error remaining, I will use AZ TRIM in the Optimizing Targeting procedure to correct it.

### 9.1.4. To Enter the HFO value in the DAC_2202:

To enter the calculated HFO value, press & hold both LEFT and RIGHT arrows for six seconds to enter the parameter menu at the EL TRIM parameter window. Press DOWN arrow key numerous times (about 21) until you have selected the REMOTE COMMAND window.

In the REMOTE COMMAND window, press the LEFT arrow key until you have underscored the left most character in the displayed value (ie the A in "A0000"). Use the UP/DOWN arrow keys to increment/decrement the underscored character until it is upper case **N** ("N0000" should appear in the command window). Press the RIGHT arrow key to move the cursor under the most significant digit, then use the UP arrow key to increment it to a value of 6 (the display is now "N6000"). Set the three digits to the right of the 6 to the three digit HFO value from 000 to 255 (corresponding to 0 to 360 degrees) that you calculated above. Use the LEFT/RIGHT keys to underscore the desired digit(s) then use the UP/DOWN arrow keys to increment/decrement the underscored value. When you have finished editing the display value, press ENTER to send the HFO value command to the PCU (but it is not save yet).

If you want to find out what the ***current*** HFO value is key in N6**999** and hit **ENTER**.

When completed, you must save the desired HFO value. Press ENTER several times to select the REMOTE PARAMETERS display. Press the LEFT or RIGHT arrow key to enter writing mode and then press the ENTER to save the HFO value in the PCUs NVRAM.

***EXAMPLE:*** In the "You Observe "Home" Pointing is LEFT of the Bow-line" example above, the HFO calculated was 222. To enter this value:

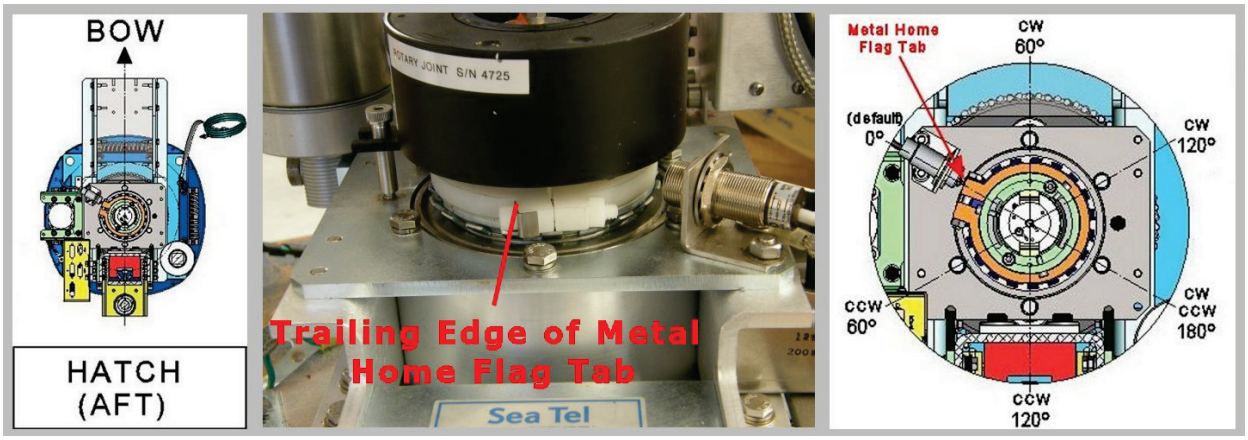
1. Set the Remote Command value to "**N6222**".
2. Press **ENTER** to send this HFO to the PCU. The display should now show "N0222".
3. When completed, you must save the desired HFO value. Press **ENTER** several times to select the **REMOTE PARAMETERS** display. Press the **LEFT** or **RIGHT** arrow key to enter writing mode and then press the **ENTER** to save the HFO value in the PCUs NVRAM.

You must drive the antenna CW in azimuth until the home switch is actuated, or re-initialize the antenna ***to begin using the new HFO value*** you have entered and saved. To re-initialize the antenna from the REMOTE COMMAND window of the ACU;

4. Press **UP** arrow key several times to return to the **REMOTE COMMAND** display.
5. Press the **LEFT** or **RIGHT** arrow key to enter edit mode. Use the **LEFT**/**RIGHT** and **UP**/**DOWN** arrow keys to set the character and digits to "^**0090**" and then press the **ENTER** key.

This resets the PCU on the antenna. The antenna will reinitialize with this command (Performs a similar function as a power reset of the antenna) and the new home flag offset value will be used to calibrate the Relative position of the antenna.

## *9.2. Mechanical Calibration of Relative Antenna Position (Home Flag Offset)*




During initialization, azimuth drives the antenna CW until the Home Flag Switch senses the trailing edge of the metal tab (***as shown in the left picture above***). The sensor will appear to go past the metal tab, then come back to the trailing edge of the metal tab and stay there. This "home" position orients the pedestal to the "BOW" reference in the radome which is directly forward of the entry hatch in the radome base. The Home Flag signal into the PCU "presets" the relative position counter to the value stored in the Home Flag Offset (**default value saved in the PCUs is 000**).

This assures that the encoder input increments and decrements from this initialization value, therefore, does not have to be precision aligned.

The metal Home Flag tab is mounted in a nylon clamp assembly. The nylon bolt/nut can be loosened to rotate the clamp around underneath the power ring. (***as shown in the center picture above***).

In the simplest scenario, if you could rotate the antenna pedestal to be in-line with the bow and then rotate the home flag clamp assembly around until the trailing edge is centered on the body of the home flag sensor, and tighten the clamp HFO would be set close enough for "Optimizing Targeting" procedure to be effective. Unfortunately, rarely is the equipment going to align where the clamp and sensor will be easy to access, reach and see, to align it this way.

The hex bolt heads in the plate below the Home Flag Clamp assembly are 60 degrees apart (***as shown in the picture on the right above***) and allow multiple points of view to calibrate rotation of the clamp to.

If you installed the ADE with the "Bow" reference of the radome oriented in-line with the bow, the antenna pedestal will be pointed in-line with the ships bow when stopped at the Home Flag position on completion of initialization (before it targets a satellite) as shown in Figure 1 in the Electrical Calibration Procedure above. In this case, when the antenna stops at the home flag and is pointed in-line with the Bow, Home Flag Offset (HFO) should be set to zero and mechanical position of the metal Home Flag tab should be left at the 0° (default) position. Any small mechanical mount error will be compensated when "Optimizing Targeting" is accomplished to correct for small variations of up to +/- 5.0 degrees.

If the ADE is installed with the "Bow" reference of the radome oriented 45° to starboard the pedestal, when at home flag position, will be pointed 45° CCW of the bow (at relative 315° as shown in Figure 2 in the Electrical Calibration Procedure above). To compensate for this, loosen the home flag clamp, rotate the trailing edge of the metal home flag tab **CW** 45° and tighten the clamp bolt (***use caution not to tighten too much and strip the nylon hardware***).. You will have to estimate this 45° rotation based on the 60° spacing of the hex bolt centers. Re-initialize the antenna and verify that when at home flag position it is pointed in-line with the ships bow. ***Do NOT change the Home Flag Offset value saved in the PCU***, small variations will be compensated for when "Optimizing Targeting" is accomplished.

If the ADE is installed with the "Bow" reference of the radome oriented 90° to port, the pedestal when at home flag position, will be pointed 90° CW of the bow (at relative 090° as shown in Figure 3 in the Electrical Calibration Procedure above). To compensate for this, loosen the home flag clamp, rotate the trailing edge of the metal home flag tab **CCW** 90° and tighten the clamp bolt (***use caution not to tighten too much and strip the nylon hardware***).. You will have to estimate this 90° rotation based on the 60° spacing of the hex bolt centers. Re-initialize the antenna and verify that when at home flag position it is pointed in-line with the ships bow. ***Do NOT change the Home Flag Offset value saved in the PCU***, small variations will be compensated for when "Optimizing Targeting" is accomplished.

# *10.* Setup – Searching

## *10.1. Searching Operation*

The ACU will initiate an automated search pattern after AGC falls below the current Threshold setting (indicates that satellite signal has been lost). The SEARCH DELAY parameter sets the amount of delay, in seconds, that the ACU will wait after AGC has fallen below the threshold value before it starts a search.

Search can be initiated manually by pressing the **NEXT** key as many times as required to access the SETUP menu, then press the **ENTER** Key to access the SEARCH sub-menu and then press the **UP** arrow key (starts a search from the current antenna position). While in the SEARCH sub-menu, pressing the **DOWN** arrow key will stop the current search.

Search is terminated automatically when the AGC level exceeds the threshold value and Tracking begins.

The ACU can be configured to use one of three search patterns. Each of the search patterns are described below. Each description includes information about the settings involved in configuring the ACU to select that particular pattern and the values that those settings would be set to, to optimize the pattern for your antenna model and the frequency band being used.

The dimensions and timing of the search pattern are determined by the SETUP parameters **SEARCH INC**, **SEARCH LIMIT**, **SEARCH DELAY** and **SWEEP INC**. Search is also affected by the *Threshold* and the *internal receiver* settings under the Satellite menu. To change any one of these parameters, refer to "Changing the Search Parameters" procedures below.

All three search patterns are conducted in a two-axis pattern consisting of alternate movements in azimuth and elevation or along the polarization angle. The size and direction of the movements are increased and reversed every other time resulting in an increasing spiral pattern as shown.

### 10.1.1. Default Standard (Box) Search Pattern

The factory default search pattern in the ACU is a standard "box" pattern. You configure the ACU to use this pattern by using the following settings:

**SEARCH INC** - set to the default value for the frequency band that your antenna model is currently being used for (typically 15 counts).

**SEARCH LIMIT** – initially set to the default value. After targeting has been optimized, the search limit can be adjusted if desired.

**SEARCH DELAY** – default, or any number of seconds from 1-255 that you would prefer that the ACU wait before starting an automatic search.

**SWEEP INC** – default value (this parameter is not used in this search pattern).

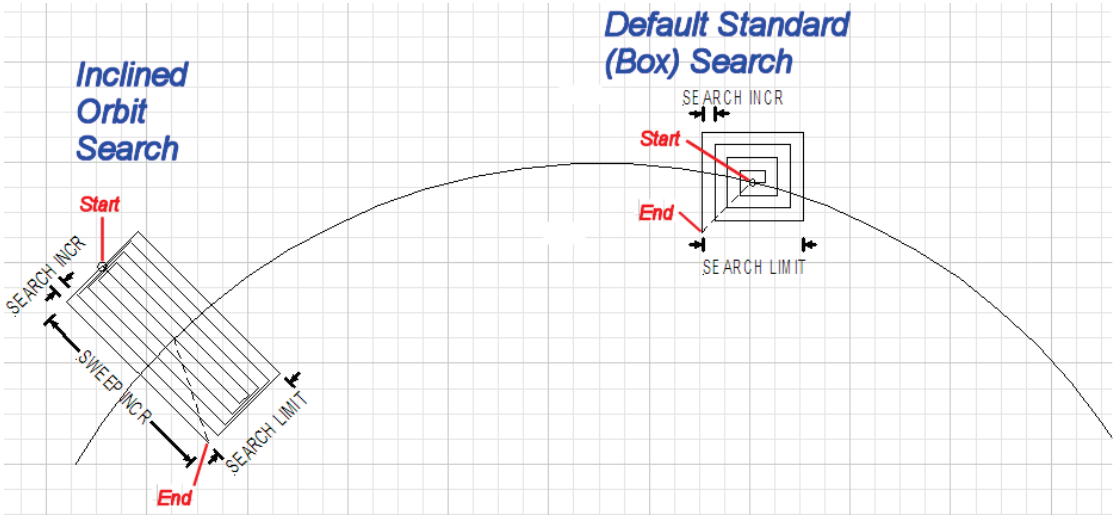
**GYRO TYPE** – must NOT be set to zero.

**SAT REF** mode – It is normally **OFF** as long as you have good gyro compass input. It ***MUST*** be **OFF** when the elevation angle is greater than 75 degrees. It ***Must*** be **ON** if you are experiencing frequent, or constant, gyro read errors (error code 0001).

Target any satellite longitude value which includes even tenths digit values (ie SAT 101.0 W or SAT 101.2 W). If the desired satellite longitude includes an odd tenths digit, you must round it up, or down, one tenth to make the tenths digit EVEN. The Antenna Control Unit calculates the Azimuth, Elevation and Polarization values it will target the antenna. Initially the antenna will go to a position that is 8 degrees above the calculated elevation, until Azimuth and Polarization have had time to complete adjustment. Then the antenna will drive down to the calculated elevation, which is the "Start" of the search pattern in the graphic below.

The antenna will then search up in azimuth one Search Increment, search up one Search Increment in elevation, search down two Search Increments in azimuth, search down two Search Increments in elevation, etc until Search Limit is reached. When the end of the search pattern is reached, the ACU will retarget the antenna to the start point shown in the graphic below.

If the desired signal is found (AND network lock is achieved in the satellite modem) at this position, or anywhere within the search pattern, the ACU will terminate search and go into Tracking mode. If the desired signal is not found the ACU will wait SEARCH DELAY seconds and then begin the search pattern again. This cycle will repeat until the desired satellite signal is found or the operator intervenes.




### 10.1.2. Inclined Orbit Search Pattern

Some older satellites, in order to save fuel to keep them exactly positioned over the Equator, are in an inclined geosynchronous orbit. The satellite remains geosynchronous but is no longer geostationary. From a fixed observation point on Earth, it would appear to trace out a figure-eight with lobes oriented north-southward once every twenty-four hours. The north-south excursions of the satellite may be too far off the center point for a default box search pattern to find that satellite at all times during the 24 hour period.

You can configure the ACU to do a special search pattern for a satellite that is in an inclined orbit by using the following settings:

**SEARCH INC** - set to the default value for the frequency band that your antenna model is currently being used for (typically 15 counts).

**SEARCH LIMIT** – leave this set to the default value for your antenna model.

**SEARCH DELAY** – default, or any number of seconds from 1-255 that you would prefer that the ACU wait before starting an automatic search.

**SWEEP INC** – set to **192** if your antenna is a Series 04 or Series 06 or Series 09. Set to **193** if your antenna is a Series 97, Series 00 or Series 07. This parameter sets the sweep increment (shown in the graphic above) to be +/- 8.0 degrees above/below the satellite arc.

**GYRO TYPE** – must NOT be set to zero.

**SAT REF** mode – It is normally **OFF** as long as you have good gyro compass input. It ***MUST*** be **OFF** when the elevation angle is greater than 75 degrees. It ***Must*** be **ON** if you are experiencing frequent, or constant, gyro read errors (error code 0001).

Target the desired satellite longitude value but include an odd tenths digit (ie if you desire to target inclined satellite 186.0 W you would key in SAT 186.1 W for the ACU to do an inclined search). The Antenna Control Unit calculates the Azimuth, Elevation and Polarization values it will target the antenna to.

Initially the antenna will go to a calculated position that is half of SWEEP INCR degrees above, and perpendicular to, the satellite arc (along the same angle as polarization for the desired satellite). This position is the "Start" of the search pattern in the graphic above. Then the antenna will drive down along the polarization angle SWEEP INCR degrees, step one Search Increment to the right (parallel to the satellite arc), search up along the polarization angle SWEEP INCR degrees, step two Search Increments to the left, search down, etc expanding out in the search pattern until Search Limit is reached. When the end of the search pattern is reached, the ACU will retarget the antenna to the calculated Azimuth and Elevation point.

If the desired signal is found (AND network lock is achieved in the satellite modem) at this position, or anywhere within the search pattern, the ACU will terminate search and go into Tracking mode. If the desired signal is not found the ACU will wait SEARCH DELAY, then target the antenna to start point shown in the graphic above and begin the search pattern again. This cycle will repeat until the desired satellite signal is found or the operator intervenes.

### 10.1.3. No Gyro Search Pattern

If the ship does not have a gyro compass to use as a heading input to the Antenna Control Unit, you may manually key in the actual heading of the vessel and then re-target the desired satellite, every time you need to re-target a satellite, or configure the ACU to do a "No Gyro Search Pattern".

You configure the ACU to use this pattern by using the following settings:

**SEARCH INC** - set to the default value for the frequency band that your antenna model is currently being used for (typically 15 counts).

**SEARCH LIMIT** – leave this set to the default value.

**SEARCH DELAY** – default, or any number of seconds from 1-255 that you would prefer that the ACU wait before starting an automatic search.

**SWEEP INC** – Larger antennas should have slower speeds and smaller antennas should have faster speeds:

***Larger*** antennas should have slower speeds set to ***0047*** (= 5 degrees/second) for ***2.4M to 3.6M antenna systems***).

***Mid size*** antennas can be driven a little faster, set to ***0063*** (= 8 degrees/second) for ***2M antennas models***).

***Smaller*** antennas should have faster speeds, set to ***0079*** (= 18 degrees/second) for ***all 0.8M to 1.5M antenna models)***.

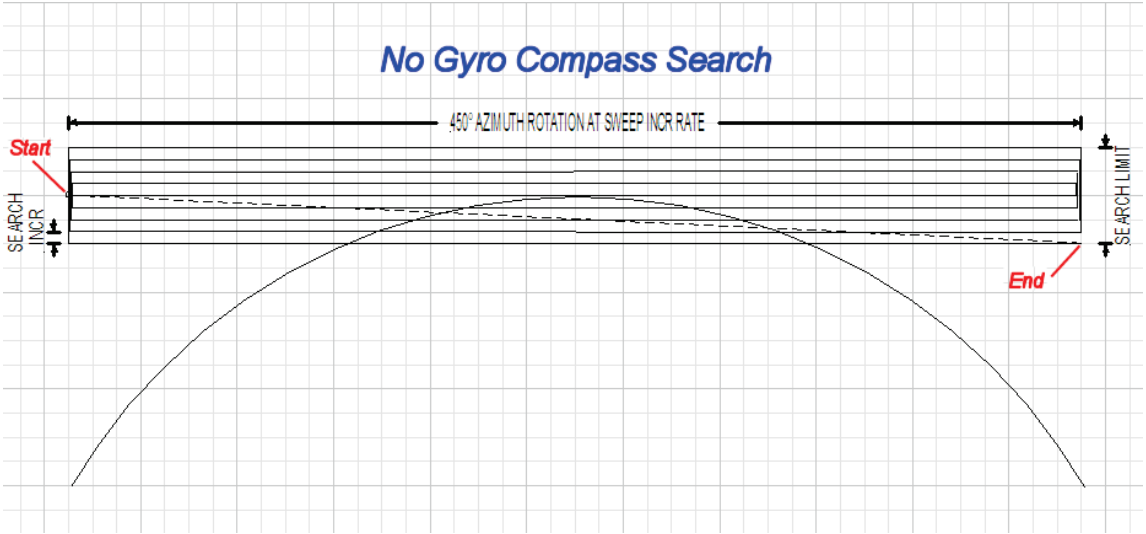
**GYRO TYPE** – ***MUST*** be set to ***zero*** for this search pattern.

**SAT REF** mode – **MUST** be **ON** for this search pattern.

Target any satellite longitude value which includes even tenths digit values (ie SAT 101.0 W or SAT 101.2 W). If the desired satellite longitude includes an odd tenths digit, you must round it up, or down, one tenth to make the tenths digit EVEN. The Antenna Control Unit calculates the Azimuth, Elevation and Polarization values it will use to target the antenna. However, without heading input, the ACU cannot target a "true azimuth" position (relative to true North). It will target the antenna to the calculated elevation and a repeatable "Start" relative azimuth position. In Series 04 antennas this relative position will be 90 degrees away from the nearest mechanical stop. In all other antennas it will be 000 degrees relative.

Initially the antenna will go to the "Start" relative azimuth position at the calculated elevation. Then the antenna will search up 450 degrees in azimuth, search up one Search Increment in elevation, search down 450 degrees in azimuth, search down two Search Increments in elevation, etc until Search Limit is reached. When the end of the search pattern is reached, the ACU will retarget the antenna back to the start point shown in the graphic below.

If the desired signal is found (AND network lock is achieved in the satellite modem) at this position, or anywhere within the search pattern, the ACU will terminate search and go into Tracking mode. If the desired signal is not found the ACU will wait SEARCH DELAY seconds and then begin the search pattern again. This cycle will repeat until the desired satellite signal is found or the operator intervenes.



## *10.2. Changing the Search Parameters*

The information above described what some of these parameters need to be set to for a specific search pattern. Below are some additional pieces of information on the other parameters and the steps to change any one of these parameters.

### 10.2.1. AUTO THRES

Sets offset of AGC tracking threshold above the average noise floor. Units are in A/D counts, approximately 20 counts/dB. A setting of 0 disables auto threshold, therefore, the operator would have to manually enter a threshold value.

When AUTO THRESHOLD is enabled (any value between 1-255), the ACU automatically re-sets the AGC tracking threshold whenever the antenna Targets (AZ, EL or SAT) or Searches. The new AGC threshold is set to the average signal level input (approximate background noise level) plus the AUTO THRES offset value. EXAMPLE: If the Noise Floor off satellite is 1000 counts of AGC and Auto Threshold is set to 100, Threshold will be set to approximately 1100 after the antenna has finished targeting or Searching.

To change the Automatic Threshold value OR manually set threshold; Note the Peak "on satellite" AGC value, move EL and note the "off satellite" (Noise Floor) AGC value. Calculate the Difference between Peak AGC and Noise Floor AGC. AUTO THRES should be set to 1/3 (to ½) of the Difference. This will usually be around 100 counts (3 dB) for a typical antenna configuration. Changes to this parameter may be required based on carrier tracking frequency, possible adjacent satellite, or ambient interference with desired satellite.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

### 10.2.2. EL STEP SIZE

For proper DishScan® operation this parameter **must** be set to factory default value of 0000.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

### 10.2.3. AZ STEP SIZE

For proper DishScan® operation this parameter **must** be set to factory default value of 0000.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

### 10.2.4. STEP INTEGRAL

For proper DishScan® operation this parameter **must** be set to factory default value of 0000.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

### 10.2.5. SEARCH INC

Sets size of search pattern increment. Units are in pedestal step resolution (12 steps per degree). The suggested setting is equal to the full 3dB beamwidth of your antenna. Default value is 15 these systems.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

### 10.2.6. SEARCH LIMIT

Sets the overall peak to peak size of the search pattern. Units are in pedestal step resolution (12 steps per degree). Default value is 100 for these systems.

After you have optimized your Targeting (refer to Optimizing Targeting) you may wish to reduce the size of the Search pattern to avoid Tracking on an adjacent satellite (ie set to 50% of its default value so that in the future it will only search half as far from your targeted position).

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

### 10.2.7. SEARCH DELAY

Sets the time-out for automatic initiation of a search operation when the signal level (AGC) drops below threshold. Units are in seconds. Range is 0-255 seconds. Default setting is 30 seconds. A setting of 0 disables the automatic search initiation.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

### 10.2.8. SWEEP INC

This parameter **MUST** be set for the desired azimuth sweep speed of a **No Gyro** search or the sweep increment dimension of an **Inclined Orbit** search (refer to the search pattern information above).

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

## *10.3. SAVE NEW PARAMETERS*

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access "SAVE NEW PARAMETERS" directly from any other menu display. Verify that the change(s) you have made is/are correct and then select "SAVE NEW PARAMETERS". Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

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# 11. Setup – Blockage & RF Radiation Hazard Zones

This section discusses how to set up blockage, or RF Radiation Hazard, zones.

## *11.1. Radiation Hazard and Blockage Mapping (AZ LIMIT parameters)*

The ACU can be programmed with relative azimuth sectors (zones) where blockage exists or where transmit power would endanger personnel who are frequently in that area. Your ACU software may allow you to set four zones or it will only three zones and include +5 volt polarization.

When the AZ LIMIT parameters are set to create these *ZONES* (up to four), several things happen when the antenna is within one of the zones:

1. Tracking continues as long as the AGC value is greater than the Threshold value. When the AGC value drops below Threshold, the antenna will wait "Search Delay" parameter amount of time and then re-target the satellite you targeted last (if 4 value is included in SYSTEM TYPE). Timeout and re-target will continue until the satellite is re-acquired and tracking can resume.
2. "BLOCKED" will be displayed in the TRACKING window wherever the antenna is inside one of the zones.
3. A contact closure to ground (or an open if the blockage logic is reversed – See SYSTEM TYPE 16 value) is provided on the SW2 terminal of the Terminal Mounting Strip. This Switch output provides a "Blocked", "RF Radiation Hazard" or "FCC TX Mute" logic output. When the antenna exits the zone it will be on satellite, tracking and the SW2 logic contact closure will open.

The lower and upper limits are user programmable and are stored in NVRAM within the ACU parameter list.

AZ LIMIT 1 is the Lower Relative AZ limit (this is the more counter-clockwise of the two points, even if it is numerically larger). AZ LIMIT 2 is the Upper Relative AZ limit (the more clockwise of the two points) for pattern mapping of ZONE 1. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 12 parameter.

AZ LIMIT 3 is the Lower Relative AZ limit (CCW point) and AZ LIMIT 4 is the Upper Relative AZ limit (CW point) for pattern mapping of ZONE 2. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 34 parameter.

AZ LIMIT 5 is the Lower Relative AZ limit (CCW point) and AZ LIMIT 6 is the Upper Relative AZ limit (CW point) for pattern mapping of ZONE 3. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 56 parameter.

AZ LIMIT 7 is the Lower Relative AZ limit (CCW point) and AZ LIMIT 8 is the Upper Relative AZ limit (CW point) for pattern mapping of ZONE 4. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 78 parameter. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

***CAUTION**: The **Lower** Relative AZ limit is the more **counter-clockwise** of the two points (even if it is numerically larger) and the **Upper** Relative AZ limit is the more clockwise of the two points. If you enter the two relative points incorrectly, Tracking and Searching will be adversely affected.*

The ACU provides a contact closure to ground on the SW2 terminal of the Terminal Mounting Strip when the antenna is pointed within any one of the blockage/hazard zones or the system is searching, targeting, unwrapping or is mis-pointed by 0.5 degrees or more (FCC TX Mute function for Transmit/Receive systems ***only***). The contact closure is a transistor switch with a current sinking capability of 0.5 Amp. Refer to "Functional Testing" for instructions on how to ***simulate*** a manual BLOCKED condition to test SW2 logic output.

When used as simple "**BLOCKED**" logic output for a single Sea Tel antenna, this output could be used to light a remote LED and/or sound a buzzer to alert someone that the antenna is blocked, and therefore signal is lost.

In a "Dual Antenna" installation, this logic output is also used to control a Dual Antenna Arbitrator panel to switch the TXIF & RXIF signals from Antenna "**A**" to Antenna "**B**" when Antenna "**A**" is blocked, and vice versa.

When used as simple "**RF Radiation Hazard**" logic output for a single Sea Tel TXRX antenna, this output could be used to suppress RF transmissions while the antenna is pointed where people would be harmed by the transmitted microwave RF power output. The SW2 output would be interfaced to the satellite modem to ***disable*** the TX output signal from the Satellite TXRX Modem whenever the antenna is within the RF Radiation Hazard zone(s).

When used for "**FCC TX Mute**" logic output for a single Sea Tel TXRX antenna, this output is used to suppress RF transmissions whenever the antenna is mis-pointed 0.5 degrees or more, is blocked, searching, targeting or unwrapping. The SW2 output would be interfaced to the satellite modem to ***disable/mute*** the TX output signal from the Satellite TXRX Modem. When the mute condition is due to antenna mis-pointing, it will not ***un-mute*** until the pointing error of the antenna is within 0.2 degrees. The default output is contact closure to ground when the antenna is mis-pointed, therefore providing a **ground** to "Mute" the satellite modem from the SW2 terminal of the Terminal Mounting Strip. If your satellite modem requires an **open** to "Mute", refer to SYSTEM TYPE parameter 16 value to reverse the output logic from the ACU.

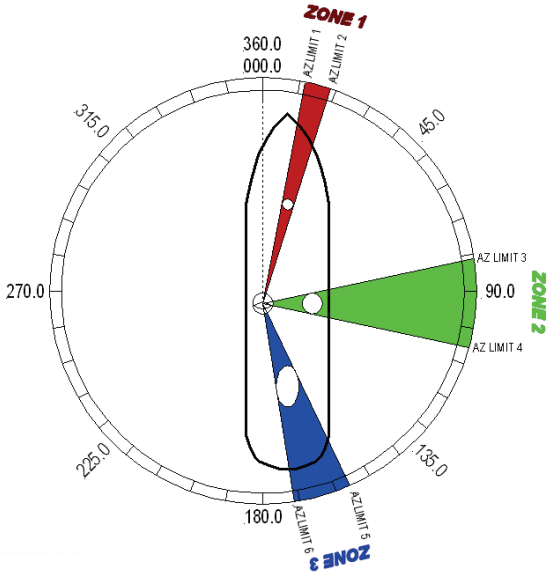
**Programming instructions**:

Determine the Relative AZ positions **where** blockage, or RF Radiation Hazard, exists. This may be done by monitoring the received signal level and the REL display readings while the ship turns or by graphing the expected blockage pattern. Elevation of the antenna in normal use also must be taken into consideration. A Mast or other structure may cause blockage at low elevation angles, but ***may not*** cause blockage when the antenna is at higher elevation angles where it is able to look over the structure. Up to four zones may be mapped. Only zones which are needed should be mapped (in AZ LIMIT pairs).

In unlimited antenna systems the Relative position of the antenna must have been calibrated by properly setting the Home Flag Offset (HFO) value in the PCU. The HFO calibrates Relative to display 0000 when the antenna is pointed in-line with the bow of the boat/ship (parallel to the bow).

Convert the relative readings to AZ LIMIT/EL LIMIT values by multiplying by 10. Enter the beginning of the ***first*** blockage region as AZ LIMIT 1 and the end of the region (clockwise direction from AZ LIMIT 1) as AZ LIMIT 2 parameters in the ACU. If needed, repeat setting AZ LIMIT 3 & 4 for a ***second*** ZONE and then AZ LIMIT 5 & 6 if a ***third*** ZONE is needed. All ***unneeded*** zone AZ LIMIT pairs ***must*** be set to 0000. Set the upper elevation limit of each blockage zone (also entered in degrees multiplied by 10).

***EXAMPLE 1 - Three blockage Zones:*** A ship has a Sea Tel antenna mounted on the port side and an Inmarsat antenna mounted on the starboard side. A mast forward, the Inmarsat antenna to starboard and an engine exhaust stack aft form the three zones where satellite signal is blocked (as shown in the graphic). In this example zone 1 is caused by the mast, zone 2 is from the Inmarsat antenna, zone 3 is from the stack and zone 4 is not needed:



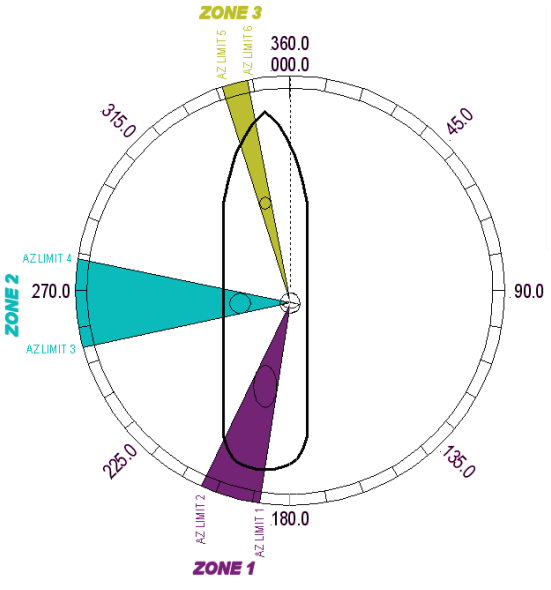

ZONE 1 begins (AZ LIMIT 1) at 12 degrees Relative and ends (AZ LIMIT 2) at 18 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 0120 and AZ LIMIT 2 value of 0180. In this case the mast height only causes blockage up to an elevation of 50 degrees, so we set EL LIMIT 12 to 0500. If the antenna is between these two AZ Limit points but the elevation is greater than 50 degrees, the antenna will no longer be blocked.

ZONE 2 begins (AZ LIMIT 3) at 82 degrees Relative and ends (AZ LIMIT 4) at 106 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 3 value of 0820 and AZ LIMIT 4 value of 1060. In this case the Inmarsat antenna height only causes blockage up to an elevation of 12 degrees, so we set EL LIMIT 34 to 0120. If the antenna is between these two AZ Limit points but the elevation is greater than 12 degrees, the antenna will no longer be blocked.

ZONE 3 begins (AZ LIMIT 5) at 156 degrees Relative and ends (AZ LIMIT 6) at 172 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 5 value of 1560 and AZ LIMIT 6 value of 1720. In this case the stack antenna height only causes blockage up to an elevation of 36 degrees, so we set EL LIMIT 56 to 0360. If the antenna is between these two AZ Limit points but the elevation is greater than 36 degrees, the antenna will no longer be blocked.

ZONE 4 is not needed. Enter AZ LIMIT 7 value of 0000 and AZ LIMIT 8 value of 0000. Set EL LIMIT 78 to 0000. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

***EXAMPLE 2 – Three blockage Zones, Dual Antenna configuration:*** A ship has 2 Sea Tel antennas, "Antenna A" mounted on the port side and "Antenna B" mounted on the starboard side. Antenna A is designated as the ***master*** antenna and its zones would be set as in example 1 above. The mast forward, Antenna A to port and the engine exhaust stack aft form the three zones where satellite signal is blocked from Antenna B. The SW2 logic output from Antenna A (ACU A) and Antenna B (ACU B) are used to control a "Dual Antenna Arbitrator", which will route satellite signal from the ***un-blocked*** antenna to the other below decks equipment. If both antennas are tracking the same satellite, they will not both be blocked at the same time. The logic output will switch to provide satellite signal to the below decks equipment from Antenna A when it is ***not blocked*** and will switch to provide satellite signal from Antenna B whenever Antenna A ***is blocked***. The switches will not change state if ***both*** antennas are blocked, or if ***both*** are on satellite.




***Antenna A is the same as the previous example and its ACU would be set to those AZ LIMIT values.***

***Antenna B ACU would be set to:***

In this example Antenna B zone 1 is caused by the stack, zone 2 is from Antenna A, zone 3 is from the mast and zone 4 is not needed.

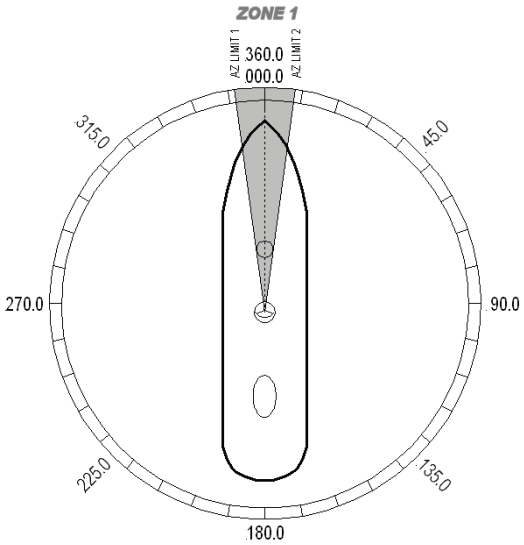
ZONE 1 begins (AZ LIMIT 1) at 188 degrees Relative and ends (AZ LIMIT 2) at 204 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 1880 and AZ LIMIT 2 value of 2040. In this case the stack height only causes blockage up to an elevation of 42 degrees, so we set EL LIMIT 12 to 0420. If the antenna is between these two AZ Limit points but the elevation is greater than 42 degrees, the antenna will no longer be blocked.

ZONE 2 begins (AZ LIMIT 3) at 254 degrees Relative and ends (AZ LIMIT 4) at 278 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 3 value of 2540 and AZ LIMIT 4 value of 2780. In this case the Antenna B height only causes blockage up to an elevation of 12 degrees, so we set EL LIMIT 34 to 0120. If the antenna is between these two AZ Limit points but the elevation is greater than 12 degrees, the antenna will no longer be blocked.

ZONE 3 begins (AZ LIMIT 5) at 342 degrees Relative and ends (AZ LIMIT 6) at 348 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 5 value of 3420 and AZ LIMIT 6 value of 3480. In this case the mast height only causes blockage up to an elevation of 41 degrees, so we set EL LIMIT 56 to 0410. If the antenna is between these two AZ Limit points but the elevation is greater than 12 degrees, the antenna will no longer be blocked.

ZONE 4 is not needed. Enter AZ LIMIT 7 value of 0000 and AZ LIMIT 8 value of 0000. Set EL LIMIT 78 to 0000. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

***EXAMPLE 3 – One blockage Zone:*** A ship has a Sea Tel antenna mounted on the center line of the ship. A mast is forward and an engine exhaust stack is aft. In this example the Stack does ***NOT*** block the satellite, only the mast forward does. In this example zone 1 is caused by the mast, zone 2, 3 and 4 are not needed:



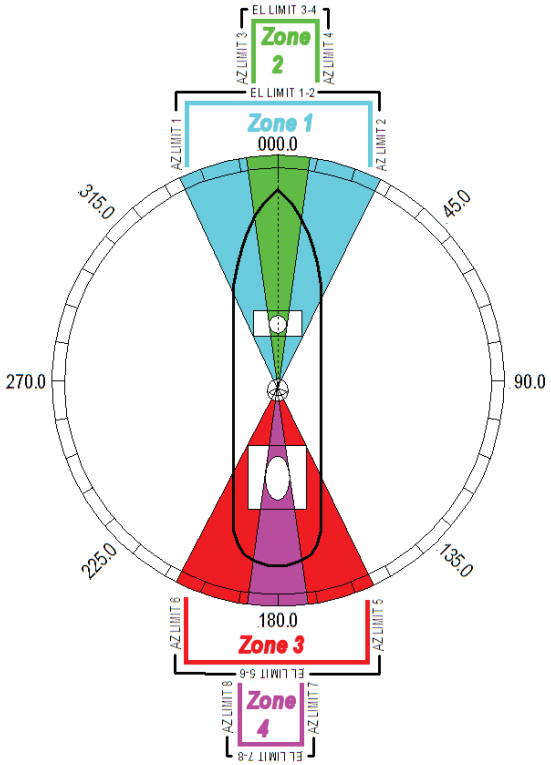

ZONE 1 begins (AZ LIMIT 1) at 352 degrees Relative and ends (AZ LIMIT 2) at 8 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 3520 and AZ LIMIT 2 value of 0080. In this case the mast height only causes blockage up to an elevation of 52 degrees, so we set EL LIMIT 12 to 0520. If the antenna is between these two AZ Limit points but the elevation is greater than 52 degrees, the antenna will no longer be blocked.

ZONE 2 is not needed. Enter AZ LIMIT 3 value of 0000 and AZ LIMIT 4 value of 0000. Set EL LIMIT 34 to 0000.

ZONE 3 is not needed. Enter AZ LIMIT 5 value of 0000 and AZ LIMIT 6 value of 0000. Set EL LIMIT 56 to 0000.

ZONE 4 is not needed. Enter AZ LIMIT 7 value of 0000 and AZ LIMIT 8 value of 0000. Set EL LIMIT 78 to 0000. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

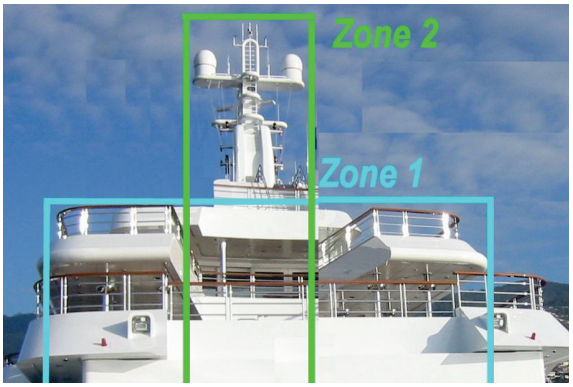
***EXAMPLE 4 - Overlaid Blockage Zones:*** A ship has a Sea Tel antenna mounted on the center line of the ship. A mast mounted on top of a deckhouse (like the picture below) is forward and an engine exhaust stack, also on a deckhouse, is aft. These two blockage areas have wide azimuth blockage at lower elevations and then a narrower azimuth area of blockage extends up to a higher value of elevation.




ZONE 1 begins (AZ LIMIT 1) at 334 degrees Relative and ends (AZ LIMIT 2) at 026 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 3340 and AZ LIMIT 2 value of 0260. In this case the mast height only causes blockage up to an elevation of 40 degrees, so we set EL LIMIT 12 to 0400. If the antenna is between these two AZ Limit points but the elevation is greater than 40 degrees, the antenna will no longer be blocked.

ZONE 2 begins (AZ LIMIT 3) at 352 degrees Relative and ends (AZ LIMIT 4) at 008 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 3 value of 3520 and AZ LIMIT 4 value of 0080. In this case the mast height only causes blockage up to an elevation of 70 degrees, so we set EL LIMIT 34 to 0700. If the antenna is between these two AZ Limit points but the elevation is greater than 70 degrees, the antenna will no longer be blocked.

ZONE 3 begins (AZ LIMIT 5) at 155 degrees Relative and ends (AZ LIMIT 6) at 205 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 5 value of 1550 and AZ LIMIT 6 value of 2050. In this case the mast height only causes blockage up to an elevation of 30 degrees, so we set EL LIMIT 56 to 0300. If the antenna is between these two AZ Limit points but the elevation is greater than 30 degrees, the antenna will no longer be blocked.




ZONE 4 begins (AZ LIMIT 7) at 173 degrees Relative and ends (AZ LIMIT 8) at 187 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 7 value of 1730 and AZ LIMIT 8 value of 1870. In this case the mast height only causes blockage up to an elevation of 55 degrees, so we set EL LIMIT 78 to 0550. If the antenna is between these two AZ Limit points but the elevation is greater than 55 degrees, the antenna will no longer be blocked. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

## *11.2. SAVE NEW PARAMETERS*

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access "SAVE NEW PARAMETERS" directly from any other menu display. Verify that the change(s) you have made is/are correct and then select "SAVE NEW PARAMETERS". Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

# 12. Setup – Modem Connections, Setup and Test

In order to be compliant with FCC Order 04-286 and WRC-03 Resolution 902 the Satellite Modem ***MUST*** be connected to the Antenna control Unit/Terminal Mounting Strip to provide TX Mute control functionality. The FCC/WARC requirements have been adopted by ITU & ETSI for them to publish similar requirements. The current FCC/WARC requirements are:

- Mute the Transmit output of the Satellite Modem used in TX/RX antenna configurations when the antenna is positioned where people may be harmed by the transmit power emanating from the antenna (RF Radiation Hazard).
- Mute the Transmit output of the Satellite Modem used in TX/RX antenna configurations when the antenna is mispointed by 0.5 degrees, or more, and keep it muted until the antenna is within 0.2 degrees of peak pointing to the satellite for a minimum of 5 seconds (FCC part 25.221 & 25.222 TX Mute requirement).

The connection will also provide External Modem Lock and GPS Latitude & Longitude.

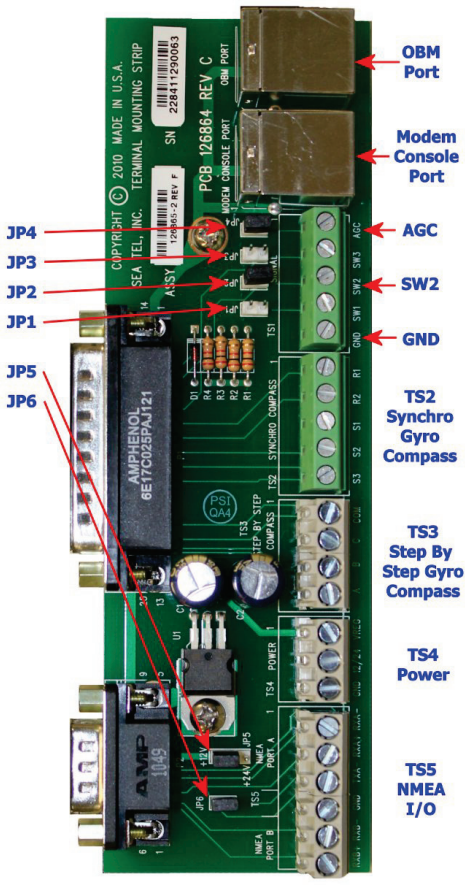
The External Modem Lock output from a satellite modem into the ACU provides a positive Network ID input to the ACU when the antenna is on the desired satellite. **This input is NOT used for Tracking purposes**, it is only used for satellite identification to assure that the satellite which has been acquired is the correct satellite (else the ACU will resume searching).

The GPS output from the ACU provides the current ships Latitude & Longitude as an input to the satellite modem for mobile mode operation.

All modems must be set for mobile operation and have hardware handshaking turned ON.

## *12.1. Jumper Selection*

JP1 – JP4 are used to couple in pull-up resistors for the below listed functions. JP5 selects the DC voltage output on TS4.




**JP1 SW1** – This output would be used for below decks Band Select - to control a band selection switch or tone generator. **Default is OPEN**.

Shorted provides DC Voltage output (determined by JP5 setting) on the SW1 screw terminal to supply voltage to a tone generator or band select switch.

Open provides continuity output (short to ground or open circuit) on the SW1 screw terminal to control devices which have their own power source.

**JP2 SW2** (blockage & RF radiation hazard output) - Provides TX Mute control to the Satellite Modem for FCC compliance in all VSAT systems. It is also used to control antenna switching via a dual antenna arbitrator in dual antenna configurations. **Default is SHORTED** when blocked. The Blocked/Unblocked logic state can be reversed by including SYSTEM TYPE 0016.

Shorted provides DC Voltage output (determined by JP5 setting) on the SW2 screw terminal to supply voltage to the satellite modem when the modem requires DC Voltage to Mute transmission. In dual antenna configurations this used for dual antenna arbitrators that require DC Voltage to switch. This hardware connection is also routed to the Console and OBM RJ45 ports.

Open provides continuity output (short to ground or open circuit) on the SW2 screw terminal to satellite modem when the modem requires continuity control (short or open) to Mute transmission. In dual antenna configurations this used for dual antenna arbitrators that require continuity control (short or open) to switch. This hardware connection is also routed to the Console and OBM RJ45 ports.

**JP3 SW3** (reserved) - Reserved for future use. **Default is OPEN**.

**JP4 AGC** (external AGC input) - Input from Satellite Modem which is used to provide a positive satellite Network Lock (RX Sync) ID when the modem is on the correct network. **Default is SHORTED**. The Locked/Unlocked logic state can be reversed by including SYSTEM TYPE 0128.

Shorted provides a pull-up DC Voltage input (determined by JP5 setting) into the ACU when the modem supplies a continuity output. This hardware connection is also routed to the Console and OBM RJ45 ports.

Open provides a DC Voltage directly from the modem into the ACU when the modem supplies a DC Voltage output. This hardware connection is also routed to the Console and OBM RJ45 ports.

**JP5** Voltage Output Select - Select 12VDC or 24VDC. **Default is 12VDC**.

**JP6** GPS NMEA Output Select - **Default is SHORTED**.

Shorted provides GPS latitude & longitude, in alternating GGA & GLL formatted messages, to be outputted on the Terminal Mounting Strip NMEA output terminals. This hardware connection is also routed to the Console and OBM RJ45 ports.

Open disconnects the GPS output from the Terminal Mounting Strip NMEA output terminals.

## *12.2. iDirect Modems*

The 5100 mobile mode can be set to 1=Serial to use the Console port RJ-45 serial connector or 2=Ethernet to use a LAN connector for TX Mute, Modem Lock and GPS position communication with the ACU.

**Terminal Mounting Strip Jumpers**:

JP1 = Open
JP2 = Shorted
JP3 = Open
JP4 = Open
JP5 must be set to 12VDC
JP6 = Shorted

| Model | Lock output | Mute input | Recommended SYSTEM TYPE | GPS Input |
|---|---|---|---|---|
| Infinity 3100 | LOW = Lock | HIGH to Mute | 23 | GGA string |
| Infinity 5100 | LOW = Lock | HIGH to Mute | 23 | GGA string |

***Note 1**: The option file **MUST** have Mobile Mode and Hardware Handshaking **ON**.*

## *12.3. Comtech Modems*

**Terminal Mounting Strip Jumpers**:

JP1 = Open
JP2 = Shorted
JP3 = Open
JP4 = Shorted
JP5 must be set to 12VDC
JP6 = Shorted

| Model | Lock output | Mute input | Recommended SYSTEM TYPE | GPS Input |
|---|---|---|---|---|
| 570L | LOW = Lock | LOW to Mute | 7 | Not Used |
| 600L | LOW = Lock | LOW to Mute | 7 | Not Used |

## *12.4. Hughes Modems*

**Terminal Mounting Strip Jumpers**:

JP1 = Open
JP2 = Shorted
JP3 = Open
JP4 = Open
JP5 must be set to 12VDC
JP6 = Shorted

| Model | Lock output | Mute input | Recommended SYSTEM TYPE | GPS Input |
|---|---|---|---|---|
| HX-150 | HIGH = Lock | HIGH to Mute | 215 | GLL string |
| HX-200 | HIGH = Lock | HIGH to Mute | 215 | GLL string |

## *12.5. STM Modems*

**Terminal Mounting Strip Jumpers**:

JP1 = Open
JP2 = Shorted
JP3 = Open
JP4 = Shorted
JP5 must be set to 24VDC
JP6 = Shorted

| Model | Lock output | Mute input | Recommended SYSTEM TYPE | GPS Input |
|---|---|---|---|---|
| SatLink 2000 | LOW = Lock | LOW to Mute | 7 | GLL string |

## *12.6. Connections (ACU to Satellite Modem)*

### 12.6.1. iDirect Modems

Infinity 3100 - Use an RJ-45 straight serial cable connected from the Terminal Mounting Strip "Console Port" connector to the Console Port connector on the rear panel of the modem.

Infinity 5100 - Use an RJ-45 straight serial cable connected from the Terminal Mounting Strip "Console Port" connector to the Console Port connector on the rear panel of the modem.

### 12.6.2. Comtech Modems

Connect the 126877 harness assembly from the 15 pin serial port on the 570L or 600L modem to the Terminal Mounting Strip screw terminals.

1. Cut the resistor/Yellow wire off of the pin on the White wire (**do NOT cut the pin off of the white wire**).
2. Connect the pin on the Black & Green wire to the GND terminal of the Terminal Mounting Strip.
3. Connect the pin on the Red wire to the SW2 terminal of the Terminal Mounting Strip.
4. Connect the pin on the White wire to the EXT AGC terminal of the Terminal Mounting Strip.

### 12.6.3. Hughes Modems

A serial cable (Hughes drawing 1502273) should be provided with the modem. Connect the 15 pin to the serial port on the HX-150 or HX-200 modem and the RJ-45 connector to the Terminal Mounting Strip "Console Port". Refer to instructions from your service provider for specific setting requirements.

### 12.6.4. STM Modems

A serial cable should be fabricated from an RJ-45 straight serial cable. Cut the RJ-45 off of one end and strip the outer sheath off. Check continuity of the wire color code to identify color of the wires from pins 1, 2, 3 & 6 to make the connections below.

1. Connect the wire from RJ-45 pin 1 to the SW2 (TX Mute) terminal of the Terminal Mounting Strip.
2. Connect the wire from RJ-45 pin 2 to the NMEA TX- (GPS) terminal of the Terminal Mounting Strip.
3. Connect the wire from RJ-45 pin 3 to the EXT AGC (Network Lock) terminal of the Terminal Mounting Strip.
4. Connect the wire from RJ-45 pin 6 to the GND (Ground) terminal of the Terminal Mounting Strip.

## *12.7. SYSTEM TYPE parameter*

The System Type parameter is used to enable a variety of system functions. ***With this parameter value set to 0, the DAC software functions will be as follows:***

- External AGC, or Modem Lock, function is used to bring an external modem lock signal from a satellite modem into the ACU as a positive ID that the antenna is on the desired satellite. This input is NOT used for Tracking purposes, it is only used during search to identify when the antenna has acquired the correct satellite. This external AGC function in the DAC software is **disabled**. Expected input is 0 VDC when the modem has RX sync/Network Lock and a positive voltage (+15 VDC ***max***) when the does not have lock.
- LNB Voltage - This function enables the Tracking Receiver to output 13/18 VDC, and/or 22kHz Tone to power an LNB and/or control a Matrix Switch. This function is **disabled**.
- The blockage output (SW2) of the ACU is a **short** to ground circuit when the antenna *is* in a programmed blockage zone, is searching, or targeting and or is mis-pointed by 0.5 degrees or greater. Whenever one of these conditions exist a transistor on the main PCB in the ACU shorts to ground providing a current sink of 0.5 amps max to control below decks dual antenna coax switches or TX Mute control to a satellite modem (for radiation hazard control or TX mute requirements for FCC compliance).
- Relative Azimuth value is normally only visible in the **Antenna** main menu display. The Azimuth entry menu normally displays Azimuth position, DishScan tracking signal and AGC.
- When Search limit is reached the antenna will return back to the origin of the search pattern.
- When the ACU power is turned ON it does not automatically target the satellite that was used last.
- Pressing RESET on the front panel of the ACU normally only resets the processors inside but does not re-target the satellite.

The functions below can be enabled to change the normal behavior of the system if desired. Select system options according to the following table. Add together all the desired options and enter the sum into the SYSTEM TYPE parameter to enable the desired functions.

| | |
|---|---|
| 128 | Reverse External Modem Lock input polarity (logic hi = lock).<br>If you know that the modem you will be using with the system provides requires a logic hi (+15 VDC max) when it has modem lock or you find the AGC reading for locked and unlocked conditions from your modem need to be reversed you must enable this function in your current SYSTEM TYPE parameter. |
| 64 | Enables LNB voltage output from the ACU.<br>This is NOT recommended for Series 09 systems, because they ALL provide the LNB voltage at the pedestal. |
| 32 | Display Relative in the Azimuth entry display.<br>Enabling this function causes REL position to take the place of the DishScan signaling in the Azimuth entry display. Relative position of the antenna is RARELY more desirable than the DishScan signaling. |
| 16 | Reverse blockage output logic (SW2 logic hi = blocked).<br>If you know that the modem you will be using with the system requires a logic hi (open circuit) to mute or you find that the Modem is being muted when the antenna is ON satellite (and un-muted when the antenna is blocked, searching or targeting) you must enable this function in your current SYSTEM TYPE parameter. |
| 8 | Reverse TX Polarity - This must be left OFF in all 09 & 10 antenna systems. |

| | |
|---|---|
| 4 | Auto SAT load after SEARCH failure.<br>Enabling this function will cause the ACU to re-target the **calculated satellite position** (rather than returning to origin). |
| 2 | Enable External Modem Lock Input (logic low = lock)<br>This enables the ACU to use the external modem input. Expected input is logic low (0 VDC) when the modem has RX sync/Network Lock and a positive voltage (+15 VDC ***max***) when the does not have lock. **This function must be enabled to use the external input from ANY modem, regardless of its locked/unlocked logic.** [If you find the AGC reading for locked and unlocked conditions need to be reversed you must add 128 to your current SYSTEM TYPE parameter]. |
| 1 | Auto SAT load on "hot" RESET and ACU Power-Up.<br>Enable this function if you want the ACU to automatically re-target the satellite whenever the system power is turned ON (after antenna initialization) or whenever the operator presses the RESET button on the from panel of the ACU. |

To change the SYSTEM TYPE parameter, press the **LEFT** arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the **UP** or **DOWN** arrow keys to increment or decrement the selected character. Use the **LEFT** or **RIGHT** arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press **ENTER** to execute the new value Continue pressing **ENTER** until SAVE NEW PARAMETERS is displayed, and then press the **RIGHT** arrow, **UP** arrow then **ENTER** to save the change(s).

## *12.8. Blockage Simulation Test – DAC-2202*

Blockage output function is used to modify the behavior of Tracking and Searching when there is a known blockage zone. The ACU provides a contact closure to ground on the SW2 terminal of the Terminal Mounting Strip when the antenna is pointed within any one of the blockage/hazard zones or the system is searching, targeting, unwrapping or is mis-pointed by 0.5 degrees or more (FCC TX Mute function for Transmit/Receive systems ***only***). The contact closure is a transistor switch with a current sinking capability of 0.5 Amp. This logic output control signal is used for:

- When used as simple "BLOCKED" logic output for a single Sea Tel antenna, this output could be used to light a remote LED and/or sound a buzzer to alert someone that the antenna is blocked, and signal is lost.
- In a "Dual Antenna" installation, this logic output(s) is used to control Dual Antenna Arbitrator panel of coax switches to switch the source inputs to the matrix switch from Antenna "A" to Antenna "B", and vice versa.
- When used as simple "**RF Radiation Hazard**" logic output for a single Sea Tel TX/RX antenna, this output could be used to suppress RF transmissions while the antenna is pointed where people would be harmed by the transmitted microwave RF power output. The SW2 output would be interfaced to the satellite modem to ***disable*** the TX output signal from the Satellite TXRX Modem whenever the antenna is within the RF Radiation Hazard zone(s).
- When used for "**FCC TX Mute**" logic output for a single Sea Tel TX/RX antenna, this output could be used to suppress RF transmissions whenever the antenna is mis-pointed 0.5 degrees or more, is blocked, searching, targeting or unwrapping. The SW2 output would be interfaced to the satellite modem to ***disable/mute*** the TX output signal from the Satellite TX/RX Modem. When the mute condition is due to antenna mis-pointing, it will not ***un-mute*** until the pointing error of the antenna is within 0.2 degrees. The default output is contact closure to ground when the antenna is mis-pointed, therefore provides a **ground** to "Mute" the satellite modem on the SW2 terminal of the Terminal Mounting Strip. If your satellite modem requires an **open** to "Mute", refer to SYSTEM TYPE parameter 16 value to reverse the output logic from the ACU.

To Test the blockage function:

1. Press the NEXT key until you are at the Status menu. (**Sea Tel – Remote** and antenna software display) Press ENTER to access the Tracking menu.
2. Press the RIGHT arrow key to bring up and move the cursor to the far right. Press the UP arrow to simulate a manual BLOCKED condition. BLOCKED will appear in the Tracking display.
3. Verify that SW2 terminal shorts to ground (or open circuit if you have SYSTEM TYPE configured to reverse the output logic). If the antenna is on the desired satellite and you have RX Synch, also verify that the Satellite Modem TX is disabled/muted (TX LED OFF).
4. Press the LEFT arrow key and then press the UP arrow key to turn the simulated blocked condition OFF. BLOCKED will disappear, leaving the ON/OFF Tracking status and the band selection in the Tracking display. Press the UP arrow key again if you wish to toggle the Tracking state.

5. Verify that SW2 terminal is open circuit (or ground if you have logic reversed). If the antenna is on the desired satellite and you have RX Synch, also verify that the Satellite Modem TX is enabled (TX LED ON).

## *12.9. Testing the Satellite Modem Lock Input – DAC-2202*

The input connections from the modem can be tested by selecting the external AGC input and monitoring the displayed value. To test the external AGC, set the tuning frequency to 0000. Normally, AGC readings below 800 are considered a low condition and indicate modem lock and AGC readings above 800 are considered a high condition and indicate modem unlock.

1. Verify that the satellite modem currently has RX Sync (RX Sync LED ON).
2. Turn tracking **OFF** so that the antenna stays pointed ON satellite.
3. Press **NEXT** until the Satellite menu is displayed. Press **ENTER** 3 times to display the Frequency entry window. Record the frequency that the tracking receiver is currently tuned to. Press **LEFT** or **RIGHT** arrow key to bring up the cursor under the units digit Use the **UP** or **DOWN** arrow keys to increment or decrement the selected digit, use the **LEFT** arrow key and the **UP** or **DOWN** arrow keys to change the next digit. Continue until frequency is set to 0000. Press the **ENTE**R key to tune the tracking receiver to this frequency.
4. View current ON satellite **LOCKED** AGC value in the lower right corner of the display and measure the DC Voltage from EXT AGC (+) terminal to the GND (-) terminal. The iDirect & Comtech modems should have an AGC readings below 800 (LOCK = low condition) and 0 VDC across the EXT AGC and GND terminals. The Hughes modem will have an AGC reading above 800 (LOCK = high condition) and 12VDC across the EXT AGC and GND terminals.
5. Disconnect the RXIF input coax from the rear of the satellite modem. It should lose RX Sync (RX Sync LED OFF).
6. View current ON satellite **UN-LOCKED** AGC value in the lower right corner of the display and measure the DC Voltage from EXT AGC (+) terminal to the GND (-) terminal. The iDirect & Comtech modems should have an AGC readings above 800 (UN-LOCKED = high condition) and about +12 VDC across the EXT AGC and GND terminals. The Hughes modem will have an AGC reading below 800 (UN-LOCKED = low condition) and 12VDC across the EXT AGC and GND terminals.
7. Reconnect the RXIF input coax to the rear of the satellite modem. It should regain RX Sync (RX Sync LED ON).
8. Press **LEFT** or **RIGHT** arrow key to bring the up the cursor under the units digit Use the **UP** or **DOWN** arrow keys to increment or decrement the selected digit, use the **LEFT** arrow key and the **UP** or **DOWN** arrow keys to change the next digit. Continue until frequency value, recorded in step 3, is displayed and press the **ENTE**R key to re-tune the tracking receiver.

## *12.10. SAVE NEW PARAMETERS*

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access "SAVE NEW PARAMETERS" directly from any other menu display. Verify that the change(s) you have made is/are correct and then select "SAVE NEW PARAMETERS". Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

# 13. Setup – Optimizing Polarity & Cross-Pol Isolation

The only way to optimize the polarization of the antenna properly is to peak the polarity angle while the system is in auto-polarization mode. This automatically adjusts the polarization of the feed by calculating the required polarization angle for the feed every 2 seconds based on ship's Latitude, Longitude and the desired Satellite Longitude.

## *13.1. Sat Skew setting*

The Satellite Skew setting in the Satellite – Tracking Receiver sub-menu (prior to NID) is used to enter the skew of the satellite to optimize polarity angle.

This feature is used in conjunction with POL OFFSET to optimize polarization of the feed. POL OFFSET will serve to calibrate the feed itself (mechanical calibration) Before adjusting the SKEW parameter, target a satellite that is of your same longitudinal position (ie from Concord, CA at 38N and 122W we would target a satellite value of 122W). Drive the reflector to 0 or 5 degrees elevation (this is so you can easily view the feed). And verify that the feed is a pure vertical. This may be visually verified by placing a level bubble on the LNB itself. During Cross-Pol isolation tests, enter in the known skew value of the satellite, then as instructed by the NOC to drive the feed assembly, increase or decrease the SAT SKEW parameter. Each digit represented on this screen represents one whole degree of feed drive.

## *13.2. Polarity Angle (POLANG) Parameters*

First of all make sure that the polang parameters are set correctly:

1. POL TYPE – should be set to 0072 (Auto-Pol mode).
2. POL OFFSET – This is initially set to factory default (0040) but will be incremented, or decremented, to calibrate the feed to the horizon with a level (bubble or digital).
3. POL SCALE – Leave this at the factory default setting of 0090.
4. Go to the TX POLARITY parameter in the Setup menu of the ACU and set this parameter to your assigned Transmit polarity (2=Horizontal or 4=Vertical).
5. Target your desired satellite (as provided by you airtime provider).
6. Verify the system has acquired the correct satellite, else continue searching until the correct satellite is acquired, and set your satellite modem (or spectrum analyzer) to view its signal level display.
7. Allow tracking to peak the satellite signal.
8. SAT SKEW – This setting will be incremented, or decremented, to optimize the polarity to peak the received satellite signal, and later to do cross-pol isolation with the airtime provider, network operation center or satellite provider.

## *13.3. Optimizing Auto-Polarization on Receive Signal*

This procedure optimizes the linear polarization of the feed based on the received signal level.

1. Verify that tracking is ON and that the antenna is peaked on your targeted satellite (targeting calculates the azimuth, elevation and polarization angles).
2. Go to the SAT SKEW parameter in the Satellite menu of the ACU. Default setting is 0000 and may be incremented, or decremented, to adjust polarization while in Auto-Pol mode. Each increment equals one degree of polarization rotation, decrement below 0000 for minus polarization.
3. Press the RIGHT arrow to edit the current value.
4. While watching the modems signal strength, the ACUs AGC value, or the spectrum analyzer satellite signal level, press the UP arrow to increment or the DOWN arrow to decrement the value and then hit the ENTER key to adjust the feed to the new value. *Allow 10 seconds between increments or decrements to allow time for feed assembly to drive to new position.*
5. Press the RIGHT key again, make another small change in the same direction and hit ENTER to carry out the adjustment.
6. Repeat this process of making small adjustments in the same direction until you see the modem signal strength, ACUs AGC value, or the spectrum analyzer satellite signal level decrease a noticeable amount (10 counts on the signal strength, 10 counts of AGC or ½ dB of signal level).
7. Note the SAT SKEW value.
8. Make a series of small changes in the opposite direction until you see the signal peak and then fall the same

amount as noted in step 6.

9. Note this SAT SKEW value.
10. Set SAT SKEW to mid way between the value noted in step 7 & 9.
11. Save your new SAT SKEW value.

## *13.4. Optimizing Auto-Polarization Cross-Pol Isolation*

During commissioning, under guidance from the network operation center, you will be adjusting to minimize the effect of your transmission on the opposite polarization which maximizes your Cross-Pol isolation. Contact your satellite provider to help you (over the phone) to optimize the polarity angle for maximum Cross-Pol isolation (this optimizes your transmit polarity and is much more accurate than trying to optimize your receive polarity).

1. Verify that tracking is ON and that the antenna is peaked on your targeted satellite (targeting calculates the azimuth, elevation and polarization angles).
2. Follow your service provider technicians instructions to set the modem to begin transmitting a CW (pure carrier) signal.
3. Go to the SAT SKEW parameter in the Satellite menu of the ACU.
4. Press the LEFT arrow to edit the current value.
5. While under direction of the technician (on the phone), press the UP arrow to increment or the DOWN arrow to decrement the value and then hit the ENTER key to adjust the feed.
6. The technician should indicate whether the adjustment you made improved, or worsened, the cross-pol isolation. If it improved he will have you make another small adjustment in the same direction. If it worsened he will have you make a small adjustment in the opposite direction.
7. Press the RIGHT key again, make the next change as directed and hit ENTER to carry out the adjustment.
8. Repeat this process of making small adjustments until the technician confirms that cross-pol isolation is optimized.
9. **Save** your new SAT SKEW value.

# 14. Setup – Other Parameters

## *14.1. SETUP Parameter display and entry menus.*

***Press and hold*** BOTH the LEFT and the RIGHT arrow keys ***for 6 seconds*** to access to the system setup parameters (at the ***EL TRIM*** selection). **Press** BOTH the LEFT and the RIGHT arrow keys **momentarily** to access to the **SAVE NEW PARAMETERS** parameter.

Access is only required after installation or repairs of your antenna system. These parameters should only be changed by an authorized service technician.

**CAUTION**: Improper setting of these parameters will cause your system to not perform properly. Also refer to the SETUP section of your Antenna manual.

## *14.2. 5V OFFSET (May not be in your software)*

CCW 5v Polang servo position reference. Refer to your antenna manual.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

## *14.3. 5V SCALE (May not be in your software)*

90 degree 5V Polang servo motion scale factor.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

## *14.4. REMOTE COMMAND*

This parameter was used to issue diagnostic commands to the PCU, but is superseded by the use of DacRemP diagnostic software that your dealer will use when necessary.

## *14.5. REMOTE MONITOR*

This parameter was used to monitor the results of a diagnostic command which was sent to the PCU.

## *14.6. To Disable/Enable DishScan®*

When running a **beam pattern** test, a **programmed sweep** for NOC/Satellite Operator, **balancing** the antenna or **motor diagnostics** where you want the drives (AZ, EL & CL) not to be oscillating you will have to **disable** DishScan®.

Select the DISHSCAN® parameter window on the ACU:

1. Press the **RIGHT** arrow, then press the **UP** arrow and last press the **ENTER** key to turn DishScan® mode ON.
2. Press the **RIGHT** arrow, then press the **DOWN** arrow and last press the **ENTER** key to turn DishScan® Mode OFF.

If you change this remote parameter, you must save the change using **REMOTE PARAMETERS**.

If DishScan® is OFF and the Step Integral parameter is set to 0000, you will get a constant ERROR 0016 (DishScan® error) and you will see zeros flashing in the lower left of the Azimuth and Elevation ENTRY menu displays. This is a visual indication that DishScan® is turned OFF.

Always assure that you ***turn DishScan® back ON*** when returning to normal operation.

## *14.7. Satellite Reference Mode*

The ships gyro compass input to the ACU may be accurate and stable in static conditions and yet may NOT be accurate or stable enough in some underway dynamic conditions. If there is no gyro compass or if the input is corrupt, not stable or not consistently accurate the tracking errors will become large enough to cause the antenna to be mis-pointed off satellite.

Satellite Reference Mode will uncouple the gyro reference from the azimuth rate sensor control loop. When operating in Satellite Reference Mode changes in ships gyro reading will not directly affect the azimuth control loop. The Pedestal Control Unit will stabilize the antenna based entirely on the azimuth rate sensor loop and the tracking information from DishScan®. This will keep the azimuth rate sensor position from eventually drifting away at a rate faster than the tracking loop can correct by using the tracking errors to regulate the rate sensor bias.

Satellite Reference Mode can be used as a diagnostic mode to determine if tracking errors are caused by faulty gyro inputs.

I t is normally **OFF** as long as you have good gyro compass input. It ***MUST*** be **OFF** when the elevation angle is greater than 75 degrees.

Satellite Reference Mode ***MUST be ON when:***

- No Gyro Compass is available
- Frequent or constant ACU Error Code 0001 (Gyro Compass has failed)

***To view, or change, the Satellite Reference Mode status****, select the SAT REF remote parameter:*

1. Press the RIGHT arrow, then press the UP arrow and last press the ENTER key to turn Satellite Reference Mode ON.
2. Press the RIGHT arrow, then press the DOWN arrow and last press the ENTER key to turn Satellite Reference Mode OFF.

If you change this remote parameter, you must save the change using REMOTE PARAMETERS.

## *14.8. REMOTE PARAMETERS*

Allows any remote parameters that have been changed (via Remote Command or Remote Tilt) to be saved. Any REMOTE changes must be saved to NVRAM in the PCU, or they will be lost when power to the antenna is cycled or remote reset command is issued. Press RIGHT arrow and then press ENTER to save the parameters in the remote PCU's NVRAM. A “Parameters Saved” message will be displayed.

# 15. Functional Testing

If not already ON, Turn ON the Power switch on the front panel of the ACU.

## *15.1. ACU / Antenna System Check*

1. Turn ACU power ON. Turn antenna Pedestal/RF Equipment power ON
2. Press **RESET** on the ACU front panel. Verify the display shows "SEA TEL INC - MASTER" and the ACU software version number. Wait 10 seconds for the display to change to "SEA TEL INC - REMOTE" and the PCU software version number. If the display shows "REMOTE INITIALIZING" wait for approximately 2 minutes for the antenna to complete initialization and report the Antenna Model and PCU software version.
3. Press the **NEXT** keys repeatedly to display the ***Ship***, ***Satellite***, ***Antenna*** and ***Status*** menus. This verifies that the displays change in the correct response to the keys.

If "**REMOTE NOT RESPONDING**" is displayed, or the displays do not change when the NEXT key is pressed, refer to the Troubleshooting Section of this manual.

## *15.2. Latitude/Longitude Auto-Update check*

This verifies that the integrated GPS antenna is automatically updating the positional information.

| | |
|---|---|
| 1. Press the **NEXT** key until the Ship's menu is displayed. | **LAT 38N LON 122W**<br>**HDG 123.4 123.4** |
| 2. Press the **ENTER** key to isolate the Latitude entry menu. | **LAT 38N** |
| 3. Press the **LEFT** arrow key to display a cursor under the numeric value. | **LAT 38N** |
| 4. Press the **UP** arrow key to increment the displayed value. | **LAT 39N** |
| 5. Press the **ENTER** key to submit change. | **LAT 39N** |
| 6. If automatic updating is working properly the Longitude value display will return to the current ships Longitude position within a few seconds. | **LAT 38N** |

## *15.3. Heading Following*

Verify that the **heading** display in the ACU is following the ships Gyro Compass.

1. Press **NEXT** repeatedly until the SHIP MENU (Heading) display is displayed. When Left and right values are displayed, left is the response from the pedestal and right in the local input from the gyrocompass.
2. Have another person call out the Gyro Compass heading to you while you observe the Heading display. The Heading display should consistently be ***exactly*** the same as the Gyro Compass value. If the heading display changes incorrectly or the red ERROR LED illuminates on the front panel, refer to the Troubleshooting section of the ACU manual.
3. Return to normal operation OR Continue with the next functional test.

## *15.4. Four Quadrant Tracking Test*

A Four Quadrant Tracking Test is the best way to test tracking (regardless of which tracking mode is being used). This tests each of the 4 quadrants (UP, DOWN, LEFT & RIGHT of peak signal AZ/EL pointing) to assure that the tracking mode being used drives the dish back to peak satellite signal level. **Note:** Return to peak should take about the same amount of time from each of the four quadrants.

1. Ensure tracking receiver parameters are set correctly and that system is on satellite with peak signal (AGC above threshold).

2. Ensure tracking LED is off – If not press the TRACK **TRACK** key to toggle tracking off
3. Press the NEXT **NEXT** arrow key a few times until Antenna menu is displayed
4. Note the current Azimuth and AGC values.
5. Press and hold the **RIGHT** arrow key to drive Azimuth down until displayed AGC drops 100 counts (approx. 2-3 dB) (Do not drive antenna so far that AGC falls below threshold)
6. Press the TRACK **TRACK** key to re-enable tracking.
7. Monitor the Azimuth and AGC Values for the next 20-30 seconds.
8. Verify the Azimuth and AGC return to the values noted in step 4.
9. Verify the amount of time it took for tracking to bring AGC back to peak is within the specifications

   ** Nominal time to get back to peak is 8-30 seconds You should also be able to observe the DishScan® tracking decisions being carried out by ACU by viewing either a 2, 4, 6, or 8 in the bottom left-hand side of the Azimuth Sub-menu display screen. A normal displayed response would be opposite than that of the axis driven, i.e. for an antenna driven up (CW) is azimuth you would expect to see a majority of 4's being displayed indicating DishScan® senses signal strength higher down in azimuth, therefore sending the Azimuth Down command to PCU.

   A flashing '2' indicates an Elevation Down command

   A flashing '8' indicates an Elevation Up command

   A flashing '4' indicates an Azimuth Down (CCW) command

   A flashing '6' indicates an Azimuth Up (CW) command

   A flashing '0' indicates No antenna drive command
10. Repeat steps 2-9 driving antenna the other 3 directions, (Replace Step 5 with below steps as each direction is tested)
11. Using the **LEFT** arrow to drive antenna down (CCW) in Azimuth
12. Using the **DOWN** arrow key to drive antenna down in Elevation
13. Using the **UP** arrow key to drive antenna up in Elevation

If problems are encountered with tracking recovery refer to 123400_C DishScan® document available on our dealer support site.

## *15.5. Blockage Simulation Test*

Blockage output function is used to modify the behavior of Tracking and Searching when there is a known blockage zone. The ACU provides a contact closure to ground on the SW2 terminal of the Terminal Mounting Strip when the antenna is pointed within any one of the blockage/hazard zones or the system is searching, targeting, unwrapping or is mis-pointed by 0.5 degrees or more (FCC TX Mute function for Transmit/Receive systems ***only***). The contact closure is a transistor switch with a current sinking capability of 0.5 Amp. This logic output control signal is used for:

- When used as simple "BLOCKED" logic output for a single Sea Tel antenna, this output could be used to light a remote LED and/or sound a buzzer to alert someone that the antenna is blocked, and signal is lost.
- In a "Dual Antenna" installation, this logic output(s) is used to control Dual Antenna Arbitrator panel of coax switches to switch the source inputs to the matrix switch from Antenna "A" to Antenna "B", and vice versa.
- When used as simple "**RF Radiation Hazard**" logic output for a single Sea Tel TX/RX antenna, this output could be used to suppress RF transmissions while the antenna is pointed where people would be harmed by the transmitted microwave RF power output. The SW2 output would be interfaced to the satellite modem to ***disable*** the TX output signal from the Satellite TXRX Modem whenever the antenna is within the RF Radiation Hazard zone(s).
- When used for "**FCC TX Mute**" logic output for a single Sea Tel TX/RX antenna, this output could be used to suppress RF transmissions whenever the antenna is mis-pointed 0.5 degrees or more, is blocked, searching, targeting or unwrapping. The SW2 output would be interfaced to the satellite modem to ***disable/mute*** the TX output signal from the Satellite TX/RX Modem. When the mute condition is due to antenna mis-pointing,

it will not ***un-mute*** until the pointing error of the antenna is within 0.2 degrees. The default output is contact closure to ground when the antenna is mis-pointed, therefore provides a **ground** to "Mute" the satellite modem on the SW2 terminal of the Terminal Mounting Strip. If your satellite modem requires an **open** to "Mute", refer to SYSTEM TYPE parameter 16 value to reverse the output logic from the ACU.

To Test the blockage function:

1. Press the NEXT key until you are at the Status menu. Press ENTER to access the Tracking menu.
2. Press the RIGHT arrow key to bring up and move the cursor to the far right. Press the UP arrow to simulate a manual BLOCKED condition. BLOCKED will appear in the Tracking display.
3. Verify that SW2 terminal shorts to ground (or open circuit if you have SYSTEM TYPE configured to reverse the output logic) and that the external alarms actuate OR the Dual Antenna Arbitrator coax switches toggle (if antenna B is not blocked) OR the Satellite Modem TX is disabled/muted.
4. Press the LEFT arrow key and then press the UP arrow key to turn the simulated blocked condition OFF. BLOCKED will disappear from the Tracking display.
5. Verify that SW2 terminal is open circuit (or ground if you have logic reversed) and that the external alarms deactivate OR the Satellite Modem TX is un-muted. The Dual Antenna Arbitrator coax switches should not toggle until you manually block Antenna B ACU.

## *15.6. Test Broadband Operation*

Open your Internet Browser and access several internet sites, email or other functions as you normally would. Operation should be the same as any equivalent service ashore (based on your subscription rate).

## *15.7. Test Voice Over IP (VOIP) Operation*

If Voice Over IP equipment has been provided and services are available from your Internet Service Provider (ISP) you should verify that this equipment and service are functioning properly.

Pick up the Telephone handset which is to be used for Voice Over IP telephone calls. Check for voice mail messages and/or place a telephone call (maybe to have them call you back). It is also important to receive a VOIP telephone call by having someone call you or calling yourself from some other telephone system (shore telephone, cellular or Inmarsat).

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# 16. Installation Troubleshooting

This section describes the theory of operation to aid in troubleshooting and adjustments of the antenna system. Also refer to the Troubleshooting section of your ACU manual for additional troubleshooting details.

| | |
|---|---|
| | ***WARNING**: Electrical Hazard – Dangerous AC Voltages exist in the Breaker Box and the Antenna Pedestal Power Supply. Observe proper safety precautions when working inside the Antenna Breaker Box or Power Supply.* |
| | ***WARNING**: RF Radiation Hazard - This stabilized antenna system is designed to be used with transmit/receive equipment manufactured by others. Refer to the documentation supplied by the manufacturer which will describe potential hazards, including exposure to RF radiation, associated with the improper use of the transmit/receive equipment. Note that the transmit/receive equipment will operate independently of the stabilized antenna system.*<br>**The ultimate responsibility for safety rests with the facility operator and the individuals who work on the system.** |
| | ***WARNING**: RF Radiation Hazard - Prior to working on the stabilized antenna system, the power to the **transmit/receive** equipment must be locked out and tagged. **Turning OFF power to the Antenna Control Unit does NOT turn Transmit power output OFF.***<br>**The ultimate responsibility for safety rests with the facility operator and the individuals who work on the system.** |
| | ***WARNING**: RF Radiation Hazard - When the transmit/receive system is in operation, no one should be allowed anywhere within the radiated beam being emitted from the reflector.*<br>**The ultimate responsibility for safety rests with the facility operator and the individuals who work on the system.** |

## *16.1. Warranty Information*

Sea Tel Inc. supports these systems with a **TWO** year warranty on parts and a **ONE** year warranty on Labor.

What's Covered by the Limited Warranty?

The Sea Tel Limited Warranty is applicable for parts and labor coverage to the complete antenna system, including all above-decks equipment (radome, pedestal, antenna, motors, electronics, wiring, etc.) and the Antenna Control Unit (ACU) or Media Xchange Point (MXP).

What's ***NOT*** Covered by the Limited Warranty?

It does ***not*** include Transmit & Receive RF Equipment, Modems, Multiplexers or other distribution equipment, whether or not supplied by Sea Tel commonly used in Satellite Communications (TXRX) Systems. These equipments are covered by the applicable warranties of the respective manufacturers.

Original Installation of the system must be accomplished by, or under the supervision of, an authorized Sea Tel dealer for the Sea Tel Limited Warranty to be valid and in force.

Should technical assistance be required to repair your system, the first contact should be to the agent/dealer you purchased the equipment from.

Please refer to the complete warranty information included with your system.

## *16.2. Troubleshooting The ACU*

The following paragraphs list the problems you might encounter when performing the functional checkout steps in the previous section of this manual. Following the problems are suggestions of where to start looking to solve the problem. Refer to the Drawings section of this manual and your Antenna manual for any/all pertinent block diagrams, schematics, wiring diagrams and assembly drawings to aid in diagnosing any type of failure.

Try pressing RESET first and then in some cases you may want to turn Power OFF for a short period of time then turn it back ON to see if that restores normal operation. Remember, with most Gyro Compass types (Synchro and SBS inputs)

you MUST enter the beginning Heading value EVERY time you power-up the ACU, before you will be able to retarget your desired satellite.

Verify that the SETUP PARAMETERS are set correctly (refer to the Setup section of this manual).

### 16.2.1. ACU display is blank

This indicates no power to the internal electronics. Assure that the front panel Power switch is ON. Check the AC line voltage on the Power Cord. Check the cables on the rear panel of the ACU to assure they are properly connected. If AC Line voltage is Ok, one at a time disconnect (and check display status) the cables plugged into J1 Gyro Compass, then J2 NMEA, then J3 M&C to see if one of these cables is shorting the ACU Power. Call your dealer to report this failure and arrange for repair service.

### 16.2.2. ACU Status displays "REMOTE NOT RESPONDING"

This indicates a problem in the Antenna Control coax cable or communications modems in the ACU and/or Antenna PCU. Check the Antenna Control Cable connections at the J4 “Antenna” jack on the rear of the ACU and at the antenna pedestal inside the radome. If the connections are good, call your dealer to report this failure and arrange for repair service.

## *16.3. Troubleshooting Ships Gyro Compass problems*

Ships Heading display does not follow ships movement and/or you are getting frequent or constant ERROR CODE 0001. Determine the type of gyro compass that is used on the ship, assure that the GYRO TYPE parameter is set correctly (refer to the setup section of this manual) and then proceed to the step that lists the troubleshooting for the correct type of Gyro Compass Signal.

### 16.3.1. STEP-BY-STEP

1. Verify that the GYRO TYPE parameter is set correctly.
2. Observe the ERROR LED on the FRONT panel. If it is illuminated, this indicates that an error was detected in the Step-By-Step input. Press RESET on the front panel. If the ERROR LED illuminates again, the problem is in the 4 connections to A, B, C and COMMON.
3. Check the connections to the Terminal Mounting Strip and to the ACU.
4. Measure the voltage between COMMON and A, B, and C. Each reading should either be near zero or 35 to 70 VDC. If all three are zero, check the repeater fuses. If some read negative and some read positive or if one reads an intermediate values the COMMON terminal is not properly connected.
5. If the ***Ship*** - Heading display is different from the actual Gyro heading, access the Heading entry menu and key in the correct heading value (refer to the operation Ship menu section). Note the reading. After the ship has turned more than one degree, compare the new gyro heading with the reading on the display, if it has moved in the opposite direction then reverse connections A and B. Reset the ACU, put in the correct ship's heading again and verify that the display reading now follows the Gyro heading.

### 16.3.2. 1:1 SYNCHRO

Observe the ship's heading display on the ACU. Compare its movement with that of the ship. If it does not move at all go to step 1. If it moves but in the wrong direction (even if it does not display the correct heading) go to step 2. If it moves in the correct direction but does not display the correct heading go to step 3. The gyro compass connects to the Terminal Mounting Strip on TB3 R1, R2, S1, S2 and S3.

***CAUTION - Electrical Shock Potentials exist on the Gyro Compass output lines. Assure that the Gyro Compass output is turned OFF when handling and connecting wiring to the Terminal Mounting Strip.***

1. The Ships Heading display does not change when the ship changes direction. Using a multimeter read between R1 and R2. It should read 115 VAC. If it does not then a fuse is blown at the gyro repeater or there is an open between the repeater and the ACU. Read between S1 and S2, S2 and S3 and finally S3 and S1. They should all read between 0 and 90 VAC. The voltage level will change as the ship turns. If one reading is very close to 0 volts wait until the ship has made a major change

in heading and then check voltage again. If the reading is still very low there is a problem in the line between the gyro repeater and the ACU or a problem in the gyro repeater itself.

2. The display changes in the direction opposite of the movement of the ship. Switch the secondary leads S1 and S2. Caution: there is 90 VAC between them! Verify that when the ship changes direction the display shows change in the same direction. If the direction is correct but the heading is incorrect go to step C.
3. The ship's heading display does not indicate the correct heading. If the display is off by 60, 180 or 300 degrees, this indicates that R1 and R2 are reversed. Reverse R1 and R2 and recheck the heading display. If the display is off by 120 or 240 degrees, this indicates that S1, S2 and S3 are in the right order but off by one place. Note their positions and carefully move the connections one position over (S1 to S2, S2 to S3, and S3 to S1). This action will offset the display by 120 degrees. Check if the display now reads correctly. If not move all three leads one more time in the same direction as last time. Verify that the ship's heading is correct.

### 16.3.3. 360:1 Synchro

Observe the ship's heading display on the ACU. Compare its movement with that of the ship. If it does not move at all go to step 1. If it moves but in the wrong direction (even if it does not display the correct heading) go to step 2. If it moves in the correct direction but does not display the correct heading go to step 3. The gyro compass connects to the Terminal Mounting Strip on TB3- R1, R2, S1, S2 and S3.

***CAUTION - Electrical Shock Potentials exist on the Gyro Compass output lines. Assure that the Gyro Compass output is turned OFF when handling and connecting wiring to the Terminal Mounting Strip.***

1. The Ships Heading display does not change when the ship changes direction. Using a multimeter read between R1 and R2. It should read 115 VAC. If it does not then a fuse is blown at the gyro repeater or there is an open between the repeater and the ACU. Read between S1 and S2, S2 and S3 and finally S3 and S1. They should all read between 0 and 90 VAC. The voltage level will change as the ship turns. If one reading is very close to 0 volts wait until the ship has made a major change in heading and then check voltage again. If the reading is still very low there is a problem in the line between the gyro repeater and the ACU or a problem in the gyro repeater itself.
2. The display changes in the direction opposite of the movement of the ship. Switch the secondary leads S1 and S2. Caution: there is 90 VAC between them! Verify that when the ship changes direction the display shows change in the same direction. If the direction is correct but the heading is incorrect go to step C.
3. If the ship's heading is different than the bridge, select the HDG function in the SHIP display mode by pressing the SHIP key 4 times. Key in the correct heading using the numeric keys and press ENTER.

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# 17. Stowing the Antenna

This antenna must be properly stowed if the ship will be underway while AC power to the Above Decks Equipment (ADE) is de-energized. Failure to do so may void your warranty. It is strongly recommended that AC Power to the ADE be supplied from an adequately rated Un-interruptible Power Supply (UPS).

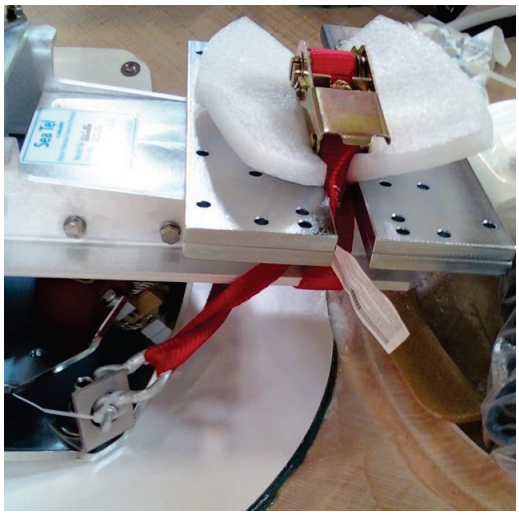
***CAUTION**: There are three Stow restraints that **MUST** be installed on this antenna pedestal **if the ship will be underway while the Above Decks Equipment is de-energized**.*

## *17.1. Installing the Stow Restraints*

The order in which the restraints are installed is not critical.

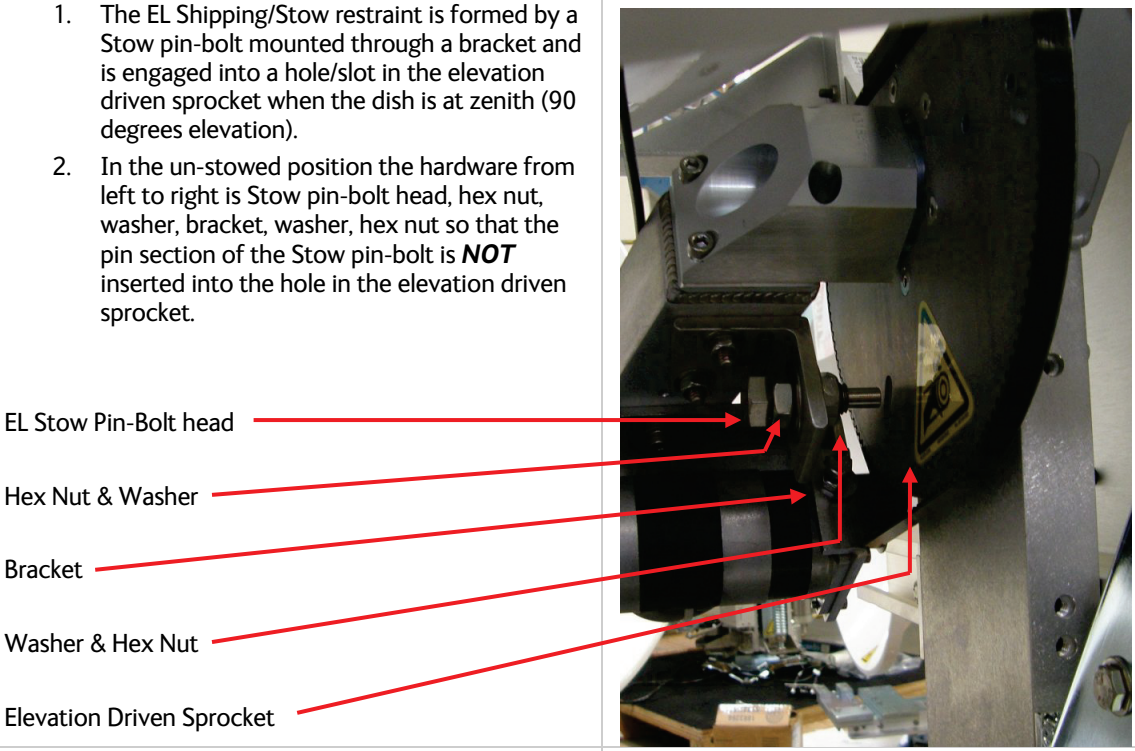
### 17.1.1. Installing the AZ Shipping/Stow Restraint

1. The AZ Shipping/Stow restraint is formed by a buckle web strap wound around the azimuth post toe weight and passed through stow clips in the base of the radome.
2. To restrain azimuth rotation of the antenna simply thread the strap through one of the clips in the base of the radome.
3. Wrap the strap around the azimuth post toe weight several times.
4. Thread the strap through an adjacent clip.
5. Thread the end of the strap through the buckle above the azimuth post toe weight.
6. Adjust the strap as necessary to enable tightening of the strap. The strap should not be extremely tight. The purpose of the strap is to restrain movement, a small amount of movement is acceptable.
7. Verify that the antenna is not able to rotate in Azimuth.

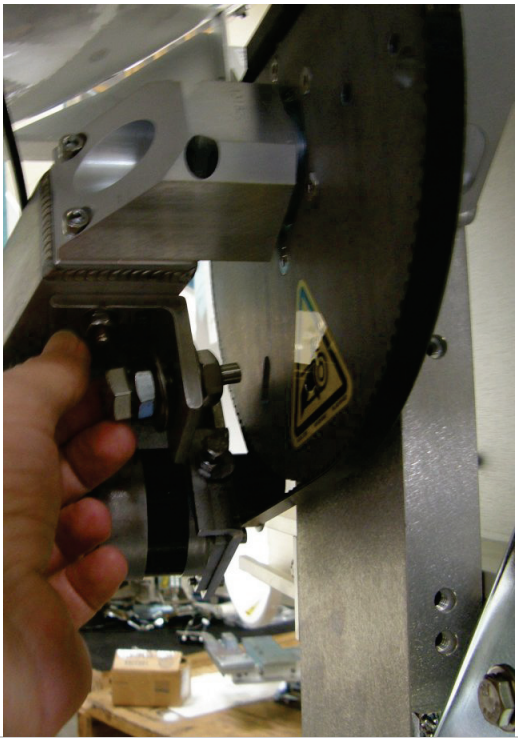


### 17.1.2. Installing the EL Shipping/Stow Restraint

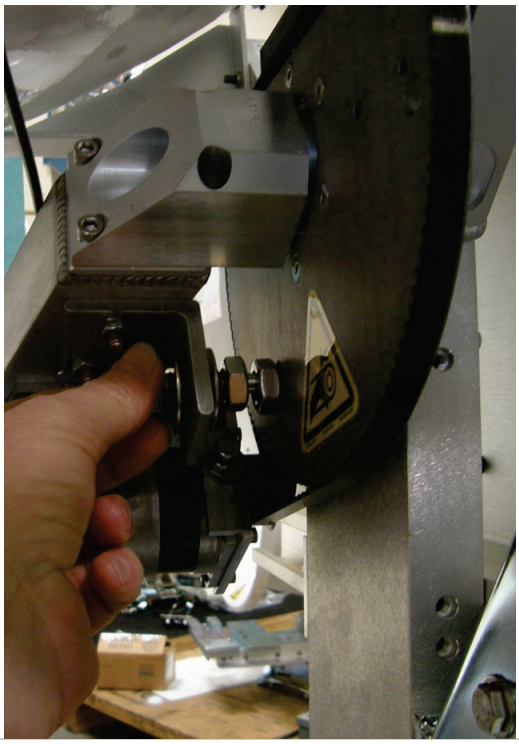
1. The EL Shipping/Stow restraint is formed by a Stow pin-bolt mounted through a bracket and is engaged into a hole/slot in the elevation driven sprocket when the dish is at zenith (90 degrees elevation).
2. In the un-stowed position the hardware from left to right is Stow pin-bolt head, hex nut, washer, bracket, washer, hex nut so that the pin section of the Stow pin-bolt is ***NOT*** inserted into the hole in the elevation driven sprocket.



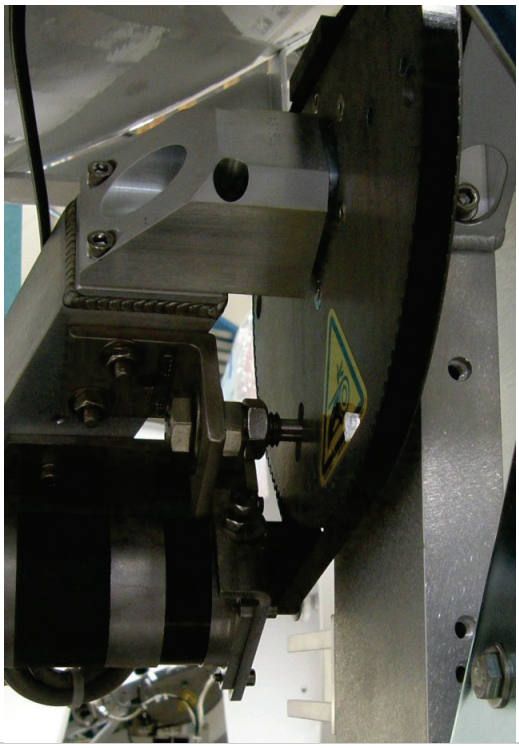

3. To restrain the elevation axis of the antenna, unthread the hex nut nearest the elevation driven sprocket. Using a ¾" open end wrench, remove the hex nut and washer from the stow pin-bolt.
4. Remove the stow pin-bolt from the bracket.



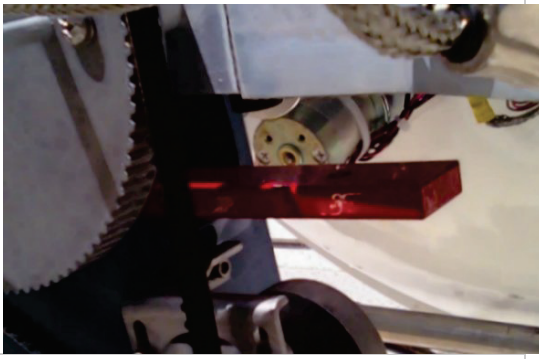
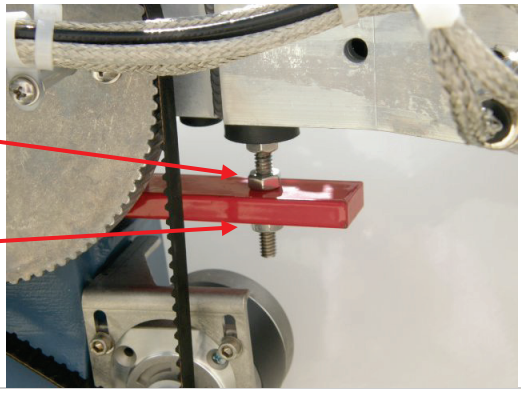
5. Remove the washer from the stow pin-bolt and unthread the hex nut from the bolt.
6. Put one of the washers onto the stow pin-bolt and insert it into the bracket toward the elevation driven sprocket.
7. Put the other washer, and then thread the 2 hex nuts onto the bolt.



8. Tighten the hex nuts to prevent the hardware from loosening while in the stowed configuration.
9. Verify that the antenna does not rotate in Elevation.



### 17.1.3. Installing the CL Shipping/Stow Restraint

| | |
|---|---|
| 1. The CL Shipping/Stow restraint is formed by a red locking bar with adjustable bumpers at each end of the bar. This mechanism is placed under the cross-level beam to lock it in place (at level). | |
| 2. If not already removed, remove an adjustable bumper, by removing the bottom nut, from one end of the locking bar.<br>3. If not already loosened, loosen the top nut up toward the rubber bumper.<br>4. Insert vacant end of the locking bar through the opening under the cross-level beam.<br>5. Insert the adjustable bumper into the vacant hole on the end of the locking bar. |  |
| 6. To restrain the cross-level axis of the antenna use a 7/16" open end wrench to tighten the nut on the top side of the locking bar until the rubber bumper is forced up against the bottom of the cross-level beam.<br>7. Verify that the antenna does NOT rotate (tilt left & right from level).<br>8. Re-install and tighten the bottom nut on the under side of the locking bar. |  |

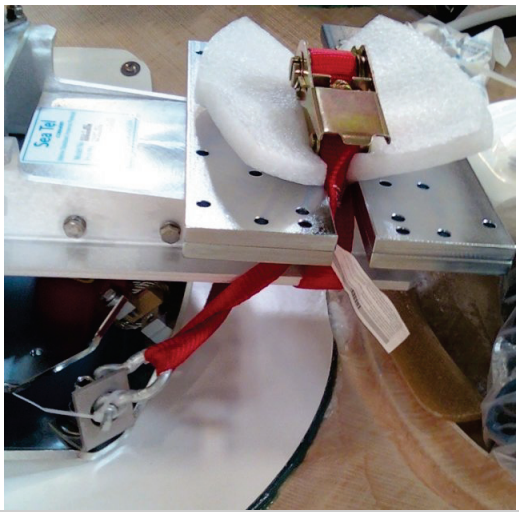
## *17.2. Removing the Shipping/Stow Restraints PRIOR to Power-Up*

The order in which the restraints are removed is not critical.

| | |
|---|---|
| | ***CAUTION**: There are three shipping/Stow restraints on this antenna pedestal that **MUST** be removed, **before energizing** the antenna, for normal operation.* |

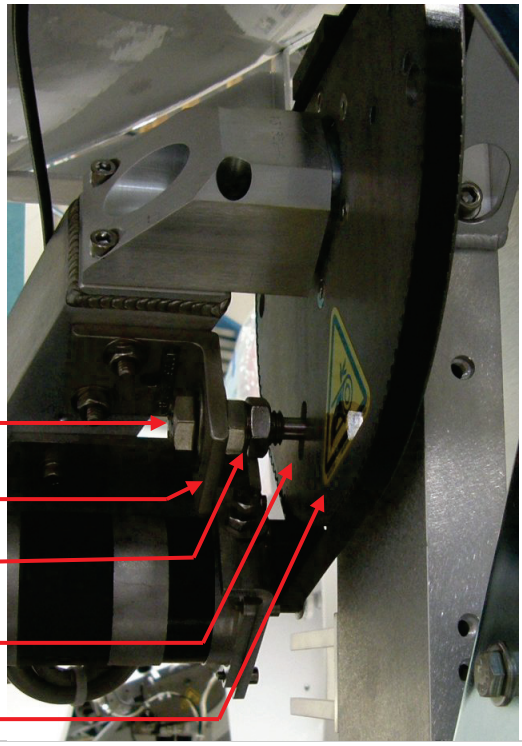
### 17.2.1. Removing the AZ Shipping/Stow Restraint

1. The AZ Shipping/Stow restraint is formed by a buckle web strap wound around the azimuth post toe weight and passed through stow clips in the base of the radome.
2. To un-restrain azimuth rotation of the antenna simply untie/unbuckle the web strap and remove it from the azimuth post and clips.
3. Save the web strap so that the antenna can be restrained in the future should it be required.
4. Verify that the antenna rotates freely and easily a full 360 degrees CW & CCW in Azimuth.

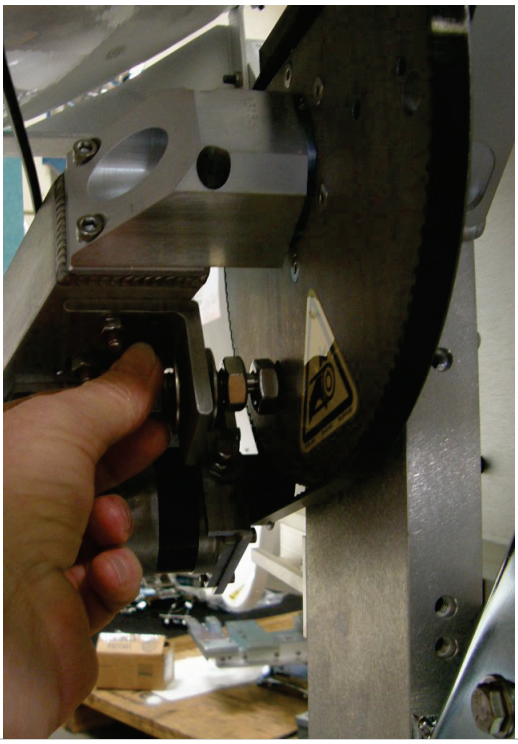


### 17.2.2. Removing the EL Shipping/Stow Restraint

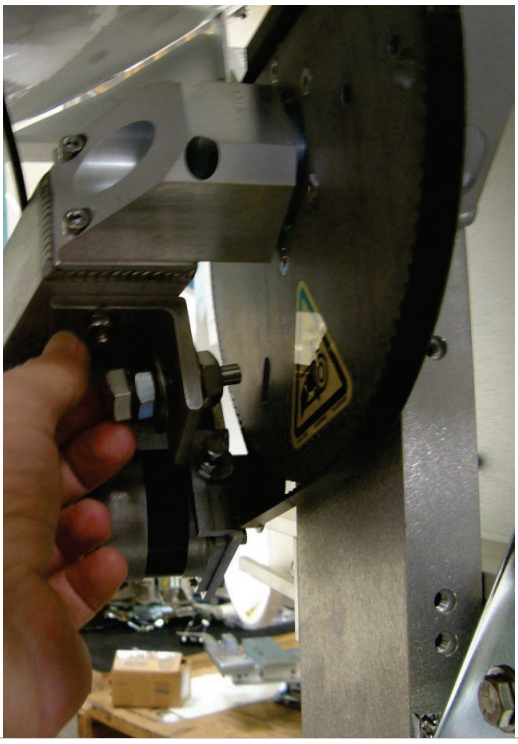
1. The EL Shipping/Stow restraint is formed by a Stow pin-bolt mounted through a bracket and is engaged into a hole/slot in the elevation driven sprocket when the dish is at zenith (90 degrees elevation).
2. In the stowed position the hardware from left to right is Stow pin-bolt head, washer, bracket, washer, hex nut, hex nut so that the pin section of the Stow pin-bolt is inserted into the hole in the elevation driven sprocket.



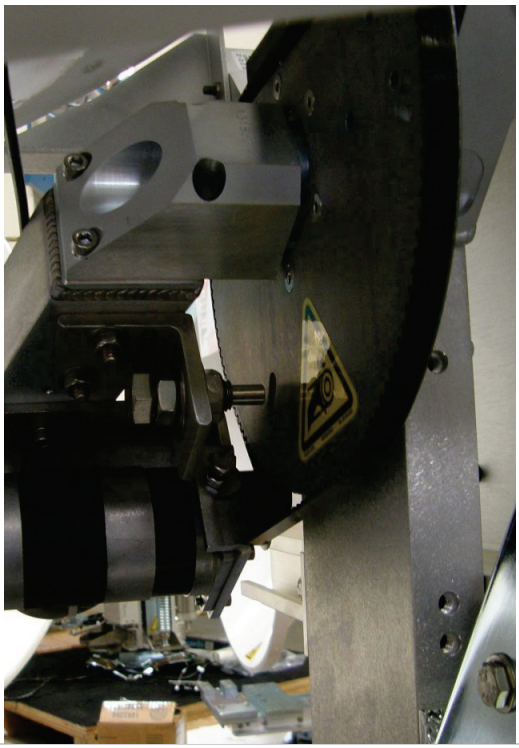
3. To un-restrain the elevation axis of the antenna, unthread the two hex nuts. Using a ¾" open end wrench, remove the hex nuts and washer from the stow pin-bolt.
4. Remove the stow pin-bolt from the bracket.



5. Remove the washer from the stow pin-bolt and thread one of the 2 hex nuts onto the bolt and tighten.
6. Put one of the washers onto the stow pin-bolt and insert it into the bracket toward the elevation driven sprocket.
7. Put the other washer, and then the other hex nut onto the bolt.



8. Tighten the hex nut to prevent the hardware from loosening while in the un-stowed configuration.
9. Verify that the antenna rotates freely through its full elevation range of motion.



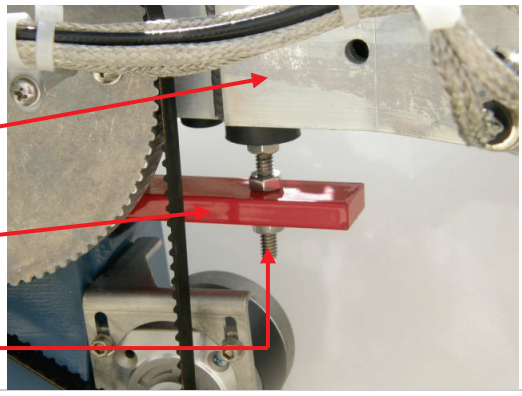
### 17.2.3. Removing the CL Shipping/Stow Restraint

1. The CL Shipping/Stow restraint is formed by a red locking bar with adjustable bumpers at each end of the bar. This mechanism is placed under the cross-level beam to lock it in place.

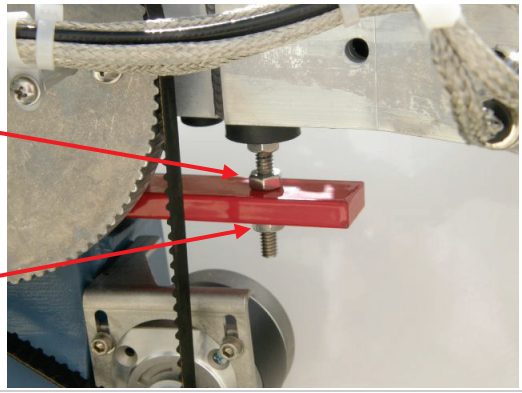
Cross-Level Beam

CL Shipping/Stow bar

Adjustable CL Locking Bumpers (only one end shown)



2. To un-restrain the cross-level axis of the antenna use a 7/16“ open end wrench to loosen the nut on the top side of the locking bar (either end of the bar).



3. Remove the bottom nut off of that adjustable bumper.
4. Remove the adjustable bumper from the locking bar.

| | |
|---|---|
| 5. Extract the locking bar from the underside of the cross-level beam and retain these parts for later re-use if it becomes necessary to stow the antenna.<br>6. Verify that the antenna rotates (tilts left & right from level) freely through its full cross-level range of motion. | |

# 18. Bluetooth Installation & Operation

## *18.1. Prerequisites*

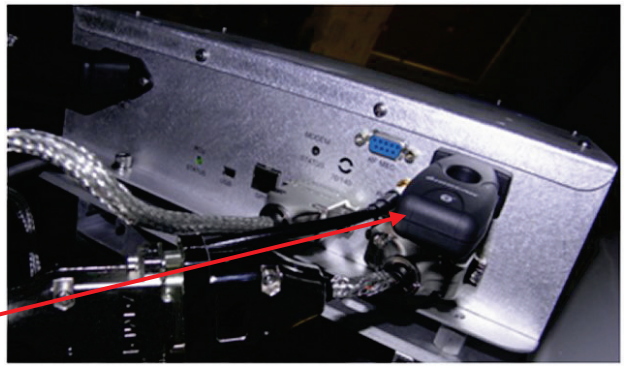
To use a Bluetooth device, as described in the information below, the ***MINIMUM*** requirements are:

- You must have a Sea Tel Series 09 antenna **with MK2 PCU**, a Series 10 antenna or a Series 11 antenna.
  - The PCU on your antenna must have software ver 2.03 or later.
- Antenna Control Unit software versions
  - DAC-2202 must have software ver 6.08 or later.
  - DAC_2302 must have software ver 7.08 or later.
- CommIF must have software ver 1.15 or later.
- Suitable computer and Operating system.

## *18.2. Installing the ADE Bluetooth Hardware*

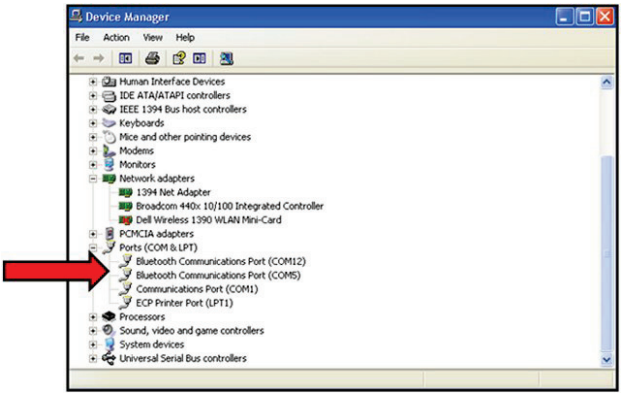
The IOGear serial Bluetooth is shown below, other manufacturer/models may be used.

1. Turn Tracking OFF at the Antenna Control unit.
2. At the ADE, open the hatch in the base of the radome.
3. Reach into the radome hatch to secure the AC power at the breaker.
4. Rotate the antenna pedestal to access the PCU.
5. Carefully enter into the radome hatch, far enough to reach the PCU.
6. Attach the SERIAL Bluetooth dongle (Receiver) to the MK2 PCU Service Port. If the device has retaining screws, secure them to prevent the device from vibrating loose.
7. Carefully exit the radome hatch.
8. Reach into the radome hatch to turn AC power ON at the breaker.
9. Allow the antenna to re-Initialize.
10. Secure the radome hatch.
11. Re-target the satellite if desired.



## *18.3. Installing the BDE Bluetooth Hardware*

The IOGear USB Bluetooth is shown below, other manufacturer/models may be used.

| | |
|---|---|
| 1. At the below decks, or portable laptop, computer insert the Bluetooth Transmitter into an available USB port. | |
| 2. The computer should automatically detect new hardware and setup the Bluetooth connection. In case the Bluetooth connection is not automatically detected you should use the CD that is included with each Bluetooth dongle. Install that software if necessary.<br>3. Once the setup is completed, you should be prompted to enter a Password to establish a link from Master (TX) to Slave (dongle-RX).<br>4. The computer will automatically assign a virtual port for the USB connection. If you are unaware of which serial connection has been assigned, open the Device Manager and check com port assignments. |  |
| 5. Identify the correct COM port for your Bluetooth device.<br>6. Once COM port is selected, open a compatible Sea Tel diagnostic program (ProgTerm or DacRemP).<br>7. In the Sea Tel diagnostic program select the appropriate COM port for the Bluetooth (refer to help in ProgTerm or DacRemP as appropriate).<br>8. You are now ready to communicate wirelessly to your Sea Tel antenna system. | |

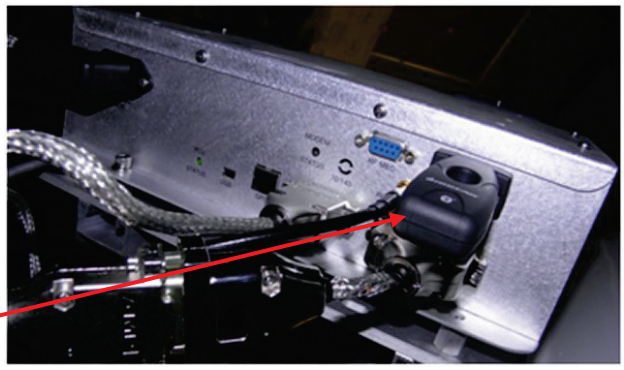
## *18.4. Diagnostic Mode*

If you are doing diagnostics and will NOT be using the system in normal operation, follow the instructions below.
If you WILL be operating normally, refer to the next section.

1. If you are diagnosing a problem (using DacRemP), use the desired diagnostic recording module(s).
2. Issue other commands as desired.
3. If ON satellite testing is to be done, target and acquire the desired satellite at the antenna control unit, or from DacRemP.
4. If tracking is required, turn Tracking ON at the antenna control unit, or from DacRemP.
5. If the Bluetooth hardware is not to remain installed, refer to the sections below to remove the hardware from ADE & BDE, before returning to normal operation.
6. When use of diagnostic mode is completed, refer to Operation mode.

## *18.5. Removing the ADE Bluetooth Hardware*

1. Turn Tracking OFF at the Antenna Control unit.
2. At the ADE, open the hatch in the base of the radome.
3. Reach into the radome hatch to secure the AC power at the breaker.
4. Rotate the antenna pedestal to access the PCU.
5. Carefully enter into the radome hatch, far enough to reach the PCU.
6. Remove the SERIAL Bluetooth dongle (Receiver) to the MK2 PCU Service Port. If the devices retaining screws were secured, unscrew them to remove the device from the PCU.
7. Carefully exit the radome hatch.
8. Reach into the radome hatch to turn AC power ON at the breaker.
9. Allow the antenna to re-Initialize.
10. Secure the radome hatch.
11. Re-target the satellite if desired.
12. Return to normal operation



## *18.6. Removing the BDE Bluetooth Hardware*

1. At the computer, remove the Bluetooth Transmitter from the computer USB port.

2. Close the Sea Tel diagnostic programs (ProgTerm or DacRemP) which were being used.
3. You are now ready to return to normal operation of your Sea Tel antenna system.

## *18.7. Installing Software via Bluetooth*

You can update the MK2 PCU software, and/or the DAC software, using the Bluetooth connection.

**NOTE**: You can **NOT** use the Bluetooth connection to update software in the CommIF, SCPC Receiver, 400MHz Modems or the Motor Driver Enclosure (MDE). If you need to update software in any of these assemblies you must install the software from a direct connection to the ACU.

1. With Bluetooth hardware installed and setup per the “Installing the ADE Bluetooth Hardware “ and “Installing the BDE Bluetooth Hardware “ paragraphs above.
2. From the computer, open ProgTerm.
3. It is strongly recommended that you save a parameter dump of the ACU & PCU parameters.

4. Update ACU or MK2 PCU software as you normally would, using ProgTerm.
5. Verify that all of the system parameters are correct after the software upload.
6. Re-target desired satellite.
7. Verify normal operation of the ACU/PCU system (refer to Functional Testing) and of the Satellite Modem.
8. Return to normal operation.

### *18.8. Normal Operation Mode*

1. Target and acquire the desired satellite at the antenna control unit, or from DacRemP.
2. Turn Tracking ON at the antenna control unit, or from DacRemP.
3. Return to normal operation.

# 19. DAC-2202 Technical Specifications

The technical specifications for the DAC-2202 ACU and some of the specifications for general Below Decks are:

## *19.1. DAC-2202 Antenna Control Unit*

The technical specifications for the DAC-2202 ACU are:

### 19.1.1. General

| | |
|---|---|
| Physical Dimensions: | Rackmount: 1.75" x 17" x 14" |
| Input Voltage: | 110/220 VAC, 50/60 Hz |
| Power Requirements: | 160 Watts maximum |
| Weight | 2.8 kg (6.2 lbs) |

### 19.1.2. Front Panel

| | |
|---|---|
| Status Indicator Display: | 6 LED annunciators for Tracking, Searching, Target, Power, Initializing, and Error |
| Alpha Numeric Display: | 2 Line 20 Character Alpha Numeric |
| Next Button | Cycles display between Ship, Satellite, Antenna, and Status |
| 4-Position Keypad | Cycles cursor Up / Down / Left / Right |
| Enter Button | Submits currently entered value to RAM |
| Reset Button | Soft Reset of the Antenna Control Unit ONLY (does not reset ADE) |
| Controls: | AC Power On/Off |

### 19.1.3. Rear Panel

Connectors:

| | |
|---|---|
| J1 "Ship Gyro" | 25 pin female D-Subminiature |
| J2 "NMEA" RS-422 Serial I/O | 9 pin male D-Subminiature |
| J3 "M&C" RS-422 Serial I/O | 9 pin female D-Subminiature |
| J4A "Antenna" RS-422 Pedestal M&C | 9 pin female D-Subminiature |
| J4B "Antenna" Control IF and Pedestal DC Power | Type F female |
| J6 "RF IN" Tracking Receiver IF Input | Type F female |
| J7 "RF OUT" Tracking Receiver IF Output | Type F female |
| "Ethernet" | RJ-45 |
| "AC Input Power 95-250VAC" | IEC receptacle |

### 19.1.4. J4A "Antenna" Pedestal M&C Interface

| | |
|---|---|
| Communications Parameters: | 9600 Baud, 8 bits, No parity, 1Stop Bit |
| Interface Protocol: | Full Duplex RS-422 |
| Base Modem Power: | 30 Volts DC |
| Interface Connector: | 9 pin male D-Subminiature |

### 19.1.5. J4B "Antenna" Pedestal M&C Interface

| | |
|---|---|
| Communications Parameters: | 9600 Baud, 8 bits, No parity, 1Stop Bit |
| Interface Protocol: | Full Duplex FSK Modulated at 70 KHz (TX) & 120 KHz (RX) |
| Antenna Power: | 30 Volts DC |
| Interface Connector: | Type F female |

### 19.1.6. J3 "M&C" Aux Serial Interface

| | |
|---|---|
| Communications Parameters: | 9600 Baud, 8 bits, No parity, 1Stop Bit |
| Interface Protocol: | Optically Isolated RS-422/RS232 |
| Interface Connector: | DE9S |

### 19.1.7. J2 "NMEA A" Interface

| | |
|---|---|
| Communications Parameters: | (Selectable) 4800 Baud, 8, N, 1 |
| Interface Protocol | Optically isolated RS-422 Receive |
| | RS-232 Transmit (Pseudo GGA echo sentence) |
| Interface Connector | DE9P |
| NMEA GPS Sentence: | xxGLL typically GPGLL or LCGLL |
| NMEA Heading Sentence: | xxHDT or xxHDM typically HCHDM or HCHDT |

### 19.1.8. J2 "NMEA B" Interface

| | |
|---|---|
| Communications Parameters: | (Selectable) 4800 Baud, 8, N, 1 |
| Interface Protocol | Optically isolated RS-422 Receive |
| Interface Connector | DE9P |
| NMEA GPS Sentence: | xxGLL typically GPGLL or LCGLL |
| NMEA Heading Sentence: | xxHDT or xxHDM typically HCHDM or HCHDT |

### 19.1.9. Ethernet

| | |
|---|---|
| Interface Protocol | 10BaseT |
| Interface Connector | RJ-45 |
| Interface Ports | 2 TCP M&C (Ports 2000, 2001) |
| | 1 UPD Upload (Port 3000) |
| | 1 Multi-User HTML (Port 80) |

### 19.1.10. DVB Compliant Tracking Receiver

Internal Satellite Identification Receiver

| | |
|---|---|
| Tuning range | 950 to 2150 MHz in 1 MHz increments in DVB Mode. |
| Input RF Level | -85 to -25 dBm typical |
| Output RF Level | Input level +/- 1 dB typical |
| Sensitivity | 30 mV / dB typical |
| Bandwidth | Selectable in DVB Mode,<br>7.5MHz with a Baud Rate =/< 5k<br>20 MHz with a Baud Rate >5k) |
| Polarity switching | 13 VDC output to select **Vertical** or **RHCP** polarity.<br>18 VDC to output select **Horizontal** or **LHCP** polarity |
| Band Switching: | 22kHz continuous tone output to select **High** band, No tone to select **Low** band. |
| Satellite ID | Network ID for DVB signals. QPSK demodulator and FEC decoder lock for DSS, or DVB without NID (forced NID). |
| QPSK Demodulator | 3000 to 30000 baud (ksps) |
| FEC Decoder | 1/2, 2/3, 3/4, 5/6, 6/7, 7/8, or Automatic. |
| Pipeline Decoder | DVB or DSS compatible. |

### 19.1.11. L-Band SCPC Narrow Band Tracking Receiver

Internal Satellite Identification Receiver

| | |
|---|---|
| Tuning range | 950 to 2150 MHz in 1 KHz increments. |
| Input RF Level | -85 to -25 dBm typical |
| Output RF Level | Input level +/- 1 dB typical |
| Sensitivity | 30 mV / dB typical |
| Bandwidth | 300 KHz |
| Polarity switching | 13 VDC output to select **Vertical** or **RHCP** polarity.<br>18 VDC to output select **Horizontal** or **LHCP** polarity |
| Band Switching: | 22kHz continuous tone output to select **High** band, No tone to select **Low** band. |

### 19.1.12. Narrow Band SCPC receiver (DAC-2302 ONLY):

| | |
|---|---|
| Frequency Range: | 60 - 80 MHz (70 MHz SCPC) Narrow Tuning Range<br>52 - 88 MHz (70 MHz SCPC) Wide Tuning Range<br>110 - 170 (140 MHz SCPC) |
| Input Level: | -90 to -30 dBm |
| Detection Bandwidth: | 30 kHz |

## *19.2. Terminal Mounting Strip*

### 19.2.1. Synchro Interface:

| | |
|---|---|
| Connectors | 5 screw terminal connections |
| Input Voltage Level | 36-110 VDC, 400 or 60 hertz |
| Synchro Ratios | 1:1, 36:1, 90 or 180:1 and 360:1 with Synchro-Digital converter<br>360:1 with Synchro-SBS converter |
| Impedance: | 1M ohm |

### 19.2.2. SBS Interface

| | |
|---|---|
| Connectors | 4 screw terminal connections |
| Input Voltage Level | 20-90 VDC |
| Interface | Opto-Isolated, |
| Polarity | Auto switching |
| Ratio | 6 steps per degree |
| Impedance: | 10K ohm |

### 19.2.3. Control Interface

#### *19.2.3.1. External AGC*

External AGC or Satellite Modem Lock Input.

| | |
|---|---|
| Connections | 2 screw terminal connections (AGC and GND) |
| Voltage Level: | 0-5 VDC |
| Impedance: | 30K ohm |
| Control: | Low Level (<1.25Vdc) = Modem Lock* |
| | High Level (>1.25Vdc) = Modem Unlock* |

*The logic sense of the external Satellite Modem Lock input can be reversed by adding 128 to the SYSTEM TYPE Parameter.

#### *19.2.3.2. SW1 Local Band Select Output*

Control local (BDE) band select switch(s) or tone generator(s).

| | |
|---|---|
| Connections | 1 screw terminal connection (SW1) |
| Control Level: | Low Band = OPEN circuit |
| | High Band = SHORT to ground |
| | Controlled by MODE – TRACKING – Band Selection. |
| | Current sink of 0.5 amps ***max*** |

#### *19.2.3.3. SW2 Blockage / TX Mute Output*

Blockage output to Dual Antenna Arbitrator coax switch panel OR TX Mute output to Satellite Modem for RF radiation hazard and/or FCC compliance.

| | |
|---|---|
| Connections | 1 screw terminal connection (SW2) |
| Control Level: | Not Blocked or Not mispointed = OPEN circuit* |
| | Blocked or mispointed = SHORT to ground * |
| | Current sink of 0.5 amps ***max*** |

*The logic level output can be reversed by adding 16 to the SYSTEM TYPE parameter.

### 19.2.4. NMEA Interface

This interface allows up to two simultaneous external GPS or NMEA 0183 compliant Heading inputs and an echoed GPS (Alternating GPGGA and GPGLL) output and is connected to the ACU via ribbon cable(s).

| | |
|---|---|
| Connections | 5 Screw terminal connections (RXA+ / RXA- input, RXB+ / RXB-input, and TXA+ output) |
| Rx Sentence Format: | **G**lobal **P**ositioning **S**ystem |
| | $xxGLL,DDmm.mmmm,N,DDDmm.mmmm,W (,UTC *optional)* (,*CS *optional)* <cr> |
| | Heading |
| | $xxHDT,xxx.x <cr> |
| Tx Sentence Format | **G**lobal **P**ositioning **S**ystem |
| | $GPGGA,0,DDmm,N,DDDmm,W <cr> <lf> |

## *19.3. Environmental Conditions*

The following requirements apply to equipment installed in weather protected locations.

| | |
|---|---|
| Temperature | 0 to 40 degrees C |
| Humidity | Up to 100% @ 40 degrees C, Non-condensing |

## *19.4. DAC-2202 AC Power Consumption*

| | |
|---|---|
| Voltage: | 100-240 VAC, 1 Phase |
| Cycle: | 47-63Hz |
| Power: | 160 Watts (**max**) |

## *19.5. Cables*

### 19.5.1. IF Signal Cables

Please refer to the "Antenna L-Band IF Coax Cables" section of the specification chapter of your antenna manual for coaxial cable recommendations.

### 19.5.2. SBS/Synchro Gyro Compass Interface Cable (Customer Furnished)

| | |
|---|---|
| Type: | Multi-conductor, Shielded |
| Number of wires | 4 Conductors for Step-By-Step Gyro, 5 Conductors for Synchro |
| Wire Gauge: | 18 AWG |
| Insulation: | 600 VAC |

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# 20. 4009-91 Technical Specifications

The specifications of your antenna system are below.

## *20.1. Antenna Reflector/Feed 4009*

The antenna assembly is comprised of the Dish, feed assembly and LNB. A variety of LNBs could be used, refer to LNB specification for the LNB that is provided with your system.:

| | |
|---|---|
| Reflector Diameter | 1.0 m (40.0 inch) |
| Reflector Type | Spun Aluminum axis symmetric D Ring focus |
| Feed | Center focus Cassegrain feed with integral 9GHz radar filter and Cross-Pol OMT |
| Cross Pol Isolation: | On axis: > 35dB, Off axis: > 30dB within 1dB contour |
| Port to Port Isolation | > 35 dB typical |
| Polarization | Linear w/motorized skew adjustment |
| Polarization control | 24 volt DC motor with pot feedback |
| Transmit frequency range | 13.75-14.5 GHz Ku Band |
| Receive frequency range | 10.70-12.75 GHz Ku Band |
| Antenna Gain | |
| TX Gain | 40.6 dBi at 14.25 GHz Typical |
| RX Gain | 39.8 dBi at 12.5 GHz Typical |
| Antenna Efficiency | 65 Percent typical minimum |
| Antenna G/T (30° elevation, clear sky) | 17.9 dB/K at 12.5 GHz **In the Radome** (typical) |

## *20.2. SMW Quad Band LNB*

| | |
|---|---|
| Band 1 | |
| Voltage Required | 13 VDC |
| Input RF Frequency | 10.95-11.70 GHz |
| Local Oscillator Frequency | 10.00 GHz |
| Output IF Frequency | 950 to 1700 MHz |
| Band 2 | |
| Voltage & Tone Required | 13 VDC + 22 KHz Tone |
| Input RF Frequency | 11.70-12.25 GHz |
| Local Oscillator Frequency | 10.75 GHz |
| Output IF Frequency | 950 to 1500 MHz |
| Band 3 | |
| Voltage Required | 18 VDC |
| Input RF Frequency | 12.25-12.75 GHz |
| Local Oscillator Frequency | 11.30 GHz |
| Output IF Frequency | 950 to 1450 MHz |
| Band 4 | |
| Voltage & Tone Required | 18 VDC + 22 KHz Tone |
| Input RF Frequency | 10.70-11.70 GHz |
| Local Oscillator Frequency | 9.75 GHz |
| Output IF Frequency | 950 to 1950 MHz |
| Gain (typ) | 54 dB |
| Noise Figure | 0.8 dB |
| Current (typ) | 270 mA |

## *20.3. TX Radio Package ( -91 systems)*

| | |
|---|---|
| SSPB (Block Up-Converter) | Codan 4908, 8 Watt Mini BUC |
| IF Input Frequency: | 950-1700 MHz |
| L.O. Frequency: | 12.80 GHz |
| RF Output Frequency: | 13.75-14.5 GHz |
| Input Power | +20VDC to +60VDC |

### 20.3.1. OPTIONAL 7550 M&C Interface Unit

Provides RJ45 TCP/IP LAN and USB Type-B serial connections. Converts FSK data to provide direct serial USB and Telnet access, and HTML pages of BUCs via an inbuilt Web server. Pass-through inline connection with the IF input eliminates additional cabling. Daisy-chain connection to 7551

### 20.3.2. OPTIONAL 7552 FSK to USB M&C Interface Unit

Provides access to the M&C serial command set of the BUC via USB. May be used as a permanent connection indoors or a temporary connection outdoors at the BUC. Pass-through inline connection with the IF input eliminates additional cabling. Powered via USB port. Daisy-chain connection to 7551.

## *20.4. BUC Power Supply*

| | |
|---|---|
| AC Input | 85-264 VAC, single phase |
| DC Voltage Output | 48 VDC |
| Max Power Consumption | 300 watts |
| Voltage output Connection | Multi-conductor |

## *20.5. Co-Pol Equipment*

| | |
|---|---|
| Co-Pol Diplexer | DPX75K-002 |
| Common Port (to feed) | WR-75 Flange, 10.70-14.5 GHz |
| Transmit Output (from SSPB) | WR-75 Flange, 13.75-14.5 GHz |
| Receive Output (to Co-Pol LNB) | WR-75 Flange, 10.70-12.75 GHz |
| Co-Pol LNB | Refer to LNB spec |

## *20.6. MK 2 Pedestal Control Unit (PCU)*

The PCU Assembly contains 3 Printed Circuit Boards (PCBs).

| | |
|---|---|
| Connectors | |
| AC Power | 100-240 VAC, 2A-1A |
| USB | Mini USB |
| GPS Input | RJ-11 connector |
| Motor Control | DA-15S connector |
| 70/140 MHz | SMA (on 4 ch Modem) 70/140 MHz input |
| Rotary Joint | SMA |
| L-Band | SMA L-Band input |
| RF M&C | DE-9S connector |
| Feed | DB-25S connector |
| Service | DE-9S connector |
| Coax Switch | |
| J2/NO/Co-Pol | SMA |
| J3/COM/Common | SMA |
| J1/NC/Cross-Pol | SMA |
| Controls | None |
| M&C Interface | 9600 Baud 400MHz FSK |
| Status LEDs | |

| | |
|---|---|
| PCU Status | Diagnostic Status of the PCU |
| Modem Status | Configuration & Diagnostic Status of the Modem |

## *20.7. 400 MHz Base & Pedestal Unlimited Azimuth Modems (3 Channel)*

| | |
|---|---|
| Combined Signals (-1,-2) | |
| Pass-Thru | 950-3200 MHz RX IF, |
| Injected | 22Khz Tone |
| | DC LNB Voltage Select |
| | 400 MHz Pedestal M&C |
| Connectors: | |
| RX IF L-Band | SMA female |
| Rotary Joint | SMA female |
| Radio / Ped M&C | 9 pin D-Sub Connectors |
| RF Pedestal M&C | Pedestal Control |
| Modulation | FSK |
| Mode | Full Duplex |
| Frequencies | |
| BDE RF M&C | TX = 447.5 Mhz +/-100 KHz |
| BDE Ped M&C | TX = 452.5 Mhz +/-100 KHz |
| ADE RF M&C | TX = 460.0 Mhz +/-100 KHz |
| ADE Ped M&C | TX = 465.0 Mhz +/-100 KHz |
| Radio/Pedestal M&C | Radio & Pedestal Control |
| Modulation | FSK |
| Mode | Full Duplex |
| Diagnostics | LED Status Indicator for Power, Link communications and Self Test |
| Pedestal Interface | RS-232/422 |
| RF Interface (Jumper Selectable) | RS-232, RS-422 (4 wire) or RS-485 (2 wire) |
| ADE/BDE Mode | Jumper Selectable |

## *20.8. MK 2 Motor Driver Enclosure (MDE)*

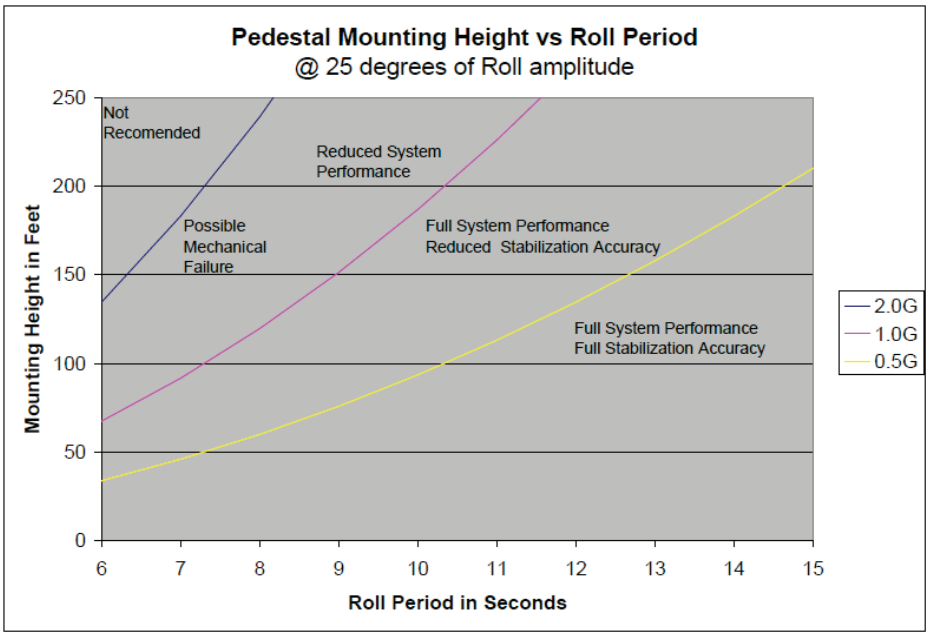
The Motor Driver Enclosure contains the Motor Driver for the 3 Brushless DC Drive motors (AZ/EL/CL) and the Brake Controller for the EL & CL motors.

| | |
|---|---|
| Connectors | |
| Drive | DA-15P connector |
| Home | DE-9S connector |
| AZ | DA-15S connector |
| EL | DA-15S connector |
| CL | DA-15S connector |
| Status LEDs | |
| CL Drive | |
| EL Drive | |
| AZ Drive | |
| MDE Status | |

## *20.9. Stabilized Antenna Pedestal Assembly*

| | |
|---|---|
| Type: | Three-axis (Level, Cross Level, AZ) |
| Stabilization: | Torque Mode Servo |
| Stab Accuracy: | 0.1 degrees RMS, 0.2 degrees MAX in presence of specified ship motions (see below). |
| Azimuth Motor: | Size 23 Brushless DC Servo w/ Encoder |
| Level and Cross Level Motors, | Size 23 Brushless DC Servo w/ Brake |
| Inertial Reference: | 3 Solid State Rate Sensors |
| Gravity Reference: | 3 axis solid state accelerometer |
| AZ transducer: | 256 line optical encoder / home switch |
| Pedestal Range of Motion: | |
| Elevation | -15 to +115 |
| Cross Level (Inclined 30 degrees) | +/- 35 degrees |
| Azimuth | Unlimited |
| Elevation Pointing | |
| 20 deg Roll | +5 to +90 degrees |
| 25 deg Roll | +10 to +90 degrees |
| Maximum Ship Motions | |
| Roll: | +/-24.7 degrees at 8 sec periods |
| Pitch: | +/-15 degrees at 6 sec periods |
| Yaw: | +/-8 degrees at 15 sec periods |
| Turning rate: | Unlimited |
| Headway: | Up to 50 knots |
| Heave / Surge / Sway | 0.5G |
| Specified Ship Motions (for stabilization accuracy tests): | |
| Roll | +/- 20 degrees at 8 second period |
| Pitch | 10 degrees FIXED |
| AZ Relative | 0, 45, & 90 degrees with respect to roll input |
| Mounting height: | Sea Tel recommends that you not exceed tangential accelerations of **0.5 G** (See chart below). |

***For Naval Engineering level information on this subject, please refer to Antenna Installation Guideline – Site Arrangement, document number 130040 available on the Sea Tel Dealer Support Site***.




## *20.10. Radome Assembly, 50"*

| | |
|---|---|
| Type | Frequency Tuned |
| Material | Composite foam/laminate |
| Size: | |
| Diameter: | 131.3 cm (51.75 inches) |
| Height: | 149.9 cm (59 inches) |
| Installed weight | ***MAX*** 147.4 kg (325 lbs.) Including antenna pedestal. |
| RF attenuation | Less than 0.3 dB @ 10.7-12.75 GHz, dry |
| | Less than 0.3 @ 14.0-14.5 GHz, dry |
| Wind: | Withstand relative average winds up to 201 Kmph (125 mph) from any direction. |
| Ingress Protection Rating | All Sea Tel radomes have an IP rating of 56 |

**Cable Passage -** The radome base is designed with a bottom center cable passage and Roxtec® Multidiameter® blocks for cable strain relief. Bottom center cable passage is recommended, however, a strain relief kit is provided with the system if off-center cable entry is required. ***Note:*** *Strain relief installation procedure MUST be followed to assure that the cored holes are properly sealed to prevent moisture absorption and de-lamination of the radome base.*

**Maintenance** – The radome must be kept clean and free of residues that will increase the RF attenuation.

**Repair** - NOTE: Damage to the seal of the inside, or outside, of the radome can allow moisture to be absorbed. This will result in de-lamination of the radome, increased weight and higher attenuation.

To maintain the RF transparency characteristics of the radome top, any cracks, scratches or other damage to the surface seal of the tuned radome top must be repaired and re-sealed by a competent "A" layered laminate, or cored deck, repair professional.

Cracks in, or other damage to, the radome base can be repaired using typical fiberglass repair techniques and proper sealing of the inside and outside surfaces. Edges of holes in the radome base must be properly sealed to prevent moisture from being absorbed into the layered construction of the radome base.

**Disposal** - Should it ever become necessary to dispose of the radome, it must be disposed of using the same handling procedures as other fiberglass materials.

## *20.11. ADE Pedestal Power Requirements:*

| | |
|---|---|
| Antenna AC Input Power | 100-240 VAC, 47-63 Hz, single phase |
| Antenna Power Consumption | 450 Watts ***MAX (brake release, pedestal drive and 8W BUC drive)*** |

## *20.12. XX09 Environmental Specifications*

### 20.12.1. Climatic Conditions

| Environmental condition | Test Level |
|---|---|
| Temperature Range (Operating) | -25º to +55º Celsius (-13º to +131º F) |
| Humidity | 100% Condensing |
| Wind Speed (relative) | 56 m/sec (125 mph) |
| Solar Radiation | 1,120 Watts per square meter, 55º Celsius |
| Icing: | Survive ice loads of 1.2g per square cm (4.5 pounds per square foot). Degraded RF performance will occur under icing conditions. |
| Rain: | Up to 101.6mm (4 inches) per hour. Degraded RF performance may occur when the radome surface is wet. |

### 20.12.2. Chemically Active Substances

| Environmental Condition | Test Level |
|---|---|
| Sea Salt | 5 percent solution |

### 20.12.3. Mechanical Conditions

| Environmental Condition | Test Level | | | |
|---|---|---|---|---|
| Systematic Vibration<br>Amplitude<br>Acceleration<br>Frequency Range | 5.0 millimeters<br>2.0 G (20 m/s2)<br>1Hz-150 Hz | | | |
| Shock (Transient Vibration)<br>Response Spectrum<br>Peak Accel., m/s2<br>Duration, ms<br>Number of Cycles<br>Directional Changes | I<br>100<br>11<br>3 each direction<br>6 | II<br>300<br>6 | III<br>500<br>3 | |
| Shock (Bump)<br>Peak Accel., m/s2<br>Duration, ms<br>Number of Cycles<br>Directional Changes | 250<br>6<br>100 ea. direction<br>6 | | | |

### 20.12.4. Transit Conditions

| Environmental Condition | Test Level |
|---|---|
| Drop (Transit Shock) | 30 G @ 8 inches |

## *20.13. Below Decks Equipment*

### 20.13.1. Antenna Control Unit (ACU)

Refer to the information in the Specifications chapter of this Manual.

### 20.13.2. Terminal Mounting Strip (TMS)

Refer to the information in the Specifications chapter of this Manual.

### 20.13.3. Satellite Modem

Please refer to the manufacturers I&O manual for this device.

### 20.13.4. Router

Please refer to the manufacturers I&O manual for this device.

## *20.14. Cables*

### 20.14.1. Antenna Control Cable (Provided from ACU to the Base MUX)

RS-422 Pedestal Interface

| | |
|---|---|
| Type | Shielded Twisted Pairs |
| Number of wires | 6 |
| Wire Gauge | 24 AWG or larger |
| Communications Parameters: | 9600 Baud, 8 bits, No parity |
| Interface Protocol: | RS-422 |
| Interface Connector: | DE-9P |

### 20.14.2. Antenna L-Band IF Coax Cables (Customer Furnished)

Due to the loss across the length of the RF coaxes at L-Band, Sea Tel recommends the following 50 ohm coax cable types (and their equivalent conductor size) for our standard pedestal installations. Type N male connectors installed on the cables MUST be 50 Ohm connectors for the center pin to properly mate with the female adapters we provide on the Base multiplexer panel and on the adapter bracket mounted inside the radome next to the breaker box.:

| Run Length | Coax Type | Typical. Loss @ 1750Mhz | Shield isolation | Center Conductor Size | Installed Bend Radius | Tensile Strength |
|---|---|---|---|---|---|---|
| <100 ft | LMR-240 | 10.704 db per 100 ft(30.48 m) | >90db | 0.056 In. (1.42 mm) | 2.5 In. (63.5 mm) | 80lb (36.3 kg) |
| up to 150 ft | LMR-400 | 5.571 db per 100 ft(30.48 m) | >90db | 0.108 In. (2.74 mm) | 4.0 in. (101.6 mm) | 160lb (72.6 kg) |
| up to 200 ft | LMR-500 | 4.496 db per 100 ft(30.48 m) | >90db | 0.142 In. (3.61 mm) | 5.0 In. (127 mm) | 260lb (118 kg) |
| Up to 300 ft | LMR-600 | 3.615 db per 100 ft(30.48 m) | >90db | 0.176 In. (4.47 mm) | 6.0 In. (152.4 mm) | 350lb (158.9 kg) |

### 20.14.3. Multi-conductor Cables (Customer Furnished)

Due to the voltage loss across the multi-conductor cables, Sea Tel recommends the following wire gauge for the AC & DC multi-conductor cables used in our standard pedestal installations:

| Run Length | Conductor Size |
|---|---|
| up to 50 ft | 20 AWG (0.8 mm) |
| up to 100 ft | 18 AWG (1.0 mm) |
| up to 150 ft | 16 AWG (1.3 mm) |
| up to 250 ft | 14 AWG (1.6 mm) |
| Up to 350 ft | 12 AWG (2.0 mm) |

# 21. DRAWINGS

The drawings listed below are provided as a part of this manual for use as a diagnostic reference.

## *21.1. DAC-2202 Antenna Control Unit Drawings*


| Drawing | Title | |
|---|---|---|
| 125411-1_R | DAC-2202 w/ DVB Rackmount General Assembly | 21-3 |
| 125411-3_R | DAC-2202 w/ SCPC Rackmount General Assembly | 21-5 |


## *21.2. 4009-91 Ku-Band Model Specific Drawings*


| Drawing | Title | |
|---|---|---|
| 133007-601_A1 | System, 4009-91 in 50" Radome | 21-10 |
| 133006-1_B | System Block Diagram, 4009-91 | 21-12 |
| 129165-1_A | 50" Radome Assembly, Tuned | 21-16 |
| 130450_B1 | Installation Arrangement, 50, 60 & 66" Radomes | 21-19 |
| 131226_A | Procedure, Radome Strain Relief Installation | 21-20 |


## *21.3. Series 09 General Drawings*


| Drawing | Title | |
|---|---|---|
| 119478-5_D | Cable Assembly, RJ-45 Serial (iDirect Modem Interface) | 21-26 |
| 126877_C1 | Harness Assembly, Comtech Modem Interface | 21-28 |
| 121628-4_R | Terminal Mounting Strip (iDirect Modem Interface) | 21-30 |
| 121628-5_R | Terminal Mounting Strip (Comtech Modem Interface) | 21-32 |
| 129710-0_B2 | Base Multiplexer Panel | 21-34 |

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SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 124265 | G | ENCLOSURE, 1U RACKMOUNT, DAC-2200 SER | |
| 2 | 1 EA | 122300 | F | LID, DAC-2200 SERIES ENCLOSURE | |
| 5 | 1 EA | 120385-2 | C | BRACKET, LID, ACU ASS'Y, 4-40 PEM | |
| 7 | 1 EA | 122445 | B1 | FRONT PANEL ASS'Y, DAC-2202 | |
| 9 | 1 EA | 122307-1 | K | DVB RECEIVER ASS'Y, STD ACU | |
| 11 | 1 EA | 124813-1 | R | PCB ASS'Y, DAC-2202 ACU | |
| 16 | 1 EA | 114836 | B2 | PCB ASS'Y, S/D CONVERTER, 12 BIT | |
| 17 | 1 EA | 123046-3 | D | HARNESS, DC POWER | |
| 18 | 1 EA | 133562-6 | A | POWER SUPPLY, SWITCHER, COTS | |
| 19 | 1 EA | 112646-13 | F6 | PCB ASS'Y, DC-DC CONVERTER, 13V | |
| 21 | 1 EA | 122660-4 | G | HARNESS, AC ENTRY, SINGLE | |
| 24 | 1 EA | 112918-9 | D | CABLE ASS'Y, RIBBON, 20 PIN | |
| 25 | 1 EA | 120740 | A1 | CABLE ASS'Y, DVB RECEIVER | |
| 30 | 1 EA | 123070 | A1 | DECAL, HIGH VOLTAGE WARNING | |
| 41 | 8 EA | 110941-3 | B | SCREW, JACK, 4-40 X .312 LG | |
| 42 | 1 EA | 114587-106 | | SCREW, RND HD, PHIL, 4-40X1/4, S.S | |
| 44 | 7 EA | 114588-144 | | SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S. | |
| 45 | 6 EA | 114576-106 | | SCREW, FLAT HD, PHIL, 4-40 x 1/4, S.S | |
| 46 | 1 EA | 114588-146 | | SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S. | |
| 47 | 1 EA | 114580-007 | | WASHER, FLAT, #6, S.S. | |
| 49 | 4 EA | 119967 | A1 | NUT, HEX, PANEL, 3/8-32 | |
| 50 | 3 EA | 126264-13 | A1 | WASHER, STAR, INTERNAL TOOTH, NARROW | |
| 58 | 1 EA | 120090-17 | C1 | MICRO ASS'Y, 12-BIT SDC | |
| 65 | 2 EA | 119745-120 | | SCREW, PAN HD, PHIL, M3 X 10 | |
| 68 | 8 EA | 127956-2 | A | NUT, HEX KEPS, 6-32, S.S. | |
| 69 | 1 EA | 124791 | A1 | LABEL CAUTION, MICROWAVE HAZARD | |
| 71 | 2 EA | 120077-116 | | SCREW, FLAT HD, PHIL, M3 X 6, S.S. | |
| 72 | 2 EA | 120077-118 | | SCREW, FLAT HD, PHIL, M3 X 8, S.S. | |

Sea Tel
COBHAM

DAC-2202, DVB RCVR, COAX IF

| PROD FAMILY COMMON | EFF. DATE 7/9/2012 | SHT 1 OF 2 | DRAWING NUMBER 125411-1 | REV R |
|---|---|---|---|---|

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 73 | 1 EA | 125193 | 1.16 | SOFTWARE, DAC-2202 ACU, COMM IF | |
| 74 | 1 EA | 124871 | 6.08 h | SOFTWARE, DAC-2202 ACU, GP32, STD | |
| 76 | 1 EA | 108929-2 | D | POWER CORD, 110V AC | (NOT SHOWN) , |
| 77 | 1 EA | 109752-3 | C | POWER CORD, 220V AC | (NOT SHOWN) , |
| 78 | 1 EA | 110959-1 | C4 | DECAL, SERIAL NUMBER/PATENT, SMALL | |
| 79 | 5 EA | 115697-2 | B | CABLE TIE MOUNT, .75 X .75 X .18, ABM | |
| 80 | 5 EA | 119801-012 | B | CABLE TIE, NYLON, 4 IN, NATURAL | |
| 81 | 3 EA | 110924-1 | A | JUMPER, .100 SPACING, 2 POS, CLOSED | |

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 124265 | G | ENCLOSURE, 1U RACKMOUNT, DAC-2200 SER | |
| 2 | 1 EA | 122300 | F | LID, DAC-2200 SERIES ENCLOSURE | |
| 5 | 1 EA | 120385-2 | C | BRACKET, LID, ACU ASS'Y, 4-40 PEM | |
| 7 | 1 EA | 122445 | B1 | FRONT PANEL ASS'Y, DAC-2202 | |
| 9 | 1 EA | 127166-1 | D1 | SCPC RECEIVER ASS'Y, ACU / PCU, V5 | |
| 11 | 1 EA | 124813-1 | R | PCB ASS'Y, DAC-2202 ACU | |
| 16 | 1 EA | 114836 | B2 | PCB ASS'Y, S/D CONVERTER, 12 BIT | |
| 17 | 1 EA | 123046-3 | D | HARNESS, DC POWER | |
| 18 | 1 EA | 133562-6 | A | POWER SUPPLY, SWITCHER, COTS | |
| 19 | 1 EA | 112646-13 | F6 | PCB ASS'Y, DC-DC CONVERTER, 13V | |
| 21 | 1 EA | 122660-4 | G | HARNESS, AC ENTRY, SINGLE | |
| 24 | 1 EA | 112918-9 | D | CABLE ASS'Y, RIBBON, 20 PIN | |
| 25 | 1 EA | 120740 | A1 | CABLE ASS'Y, DVB RECEIVER | |
| 30 | 1 EA | 123070 | A1 | DECAL, HIGH VOLTAGE WARNING | |
| 41 | 8 EA | 110941-3 | B | SCREW, JACK, 4-40 X .312 LG | |
| 42 | 1 EA | 114587-106 | | SCREW, RND HD, PHIL, 4-40X1/4, S.S | |
| 44 | 7 EA | 114588-144 | | SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S. | |
| 45 | 6 EA | 114576-106 | | SCREW, FLAT HD, PHIL, 4-40 x 1/4, S.S | |
| 46 | 1 EA | 114588-146 | | SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S. | |
| 47 | 1 EA | 114580-007 | | WASHER, FLAT, #6, S.S. | |
| 49 | 4 EA | 119967 | A1 | NUT, HEX, PANEL, 3/8-32 | |
| 50 | 3 EA | 126264-13 | A1 | WASHER, STAR, INTERNAL TOOTH, NARROW | |
| 58 | 1 EA | 120090-17 | C1 | MICRO ASS'Y, 12-BIT SDC | |
| 65 | 2 EA | 119745-120 | | SCREW, PAN HD, PHIL, M3 X 10 | |
| 68 | 8 EA | 127956-2 | A | NUT, HEX KEPS, 6-32, S.S. | |
| 69 | 1 EA | 124791 | A1 | LABEL CAUTION, MICROWAVE HAZARD | |
| 71 | 2 EA | 120077-116 | | SCREW, FLAT HD, PHIL, M3 X 6, S.S. | |
| 72 | 2 EA | 120077-118 | | SCREW, FLAT HD, PHIL, M3 X 8, S.S. | |

Sea Tel
COBHAM

DAC-2202, SCPC RCVR, 9 WIRE IF

| PROD FAMILY COMMON | EFF. DATE 7/9/2012 | SHT 1 OF 2 | DRAWING NUMBER 125411-3 | REV R |
|---|---|---|---|---|

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 73 | 1 EA | 125193 | 1.16 | SOFTWARE, DAC-2202 ACU, COMM IF | |
| 74 | 1 EA | 124871 | 6.08 h | SOFTWARE, DAC-2202 ACU, GP32, STD | |
| 76 | 1 EA | 108929-2 | D | POWER CORD, 110V AC | (NOT SHOWN) , |
| 77 | 1 EA | 109752-3 | C | POWER CORD, 220V AC | (NOT SHOWN) , |
| 78 | 1 EA | 110959-1 | C4 | DECAL, SERIAL NUMBER/PATENT, SMALL | |
| 79 | 5 EA | 115697-2 | B | CABLE TIE MOUNT, .75 X .75 X .18, ABM | |
| 80 | 5 EA | 119801-012 | B | CABLE TIE, NYLON, 4 IN, NATURAL | |
| 81 | 3 EA | 110924-1 | A | JUMPER, .100 SPACING, 2 POS, CLOSED | |

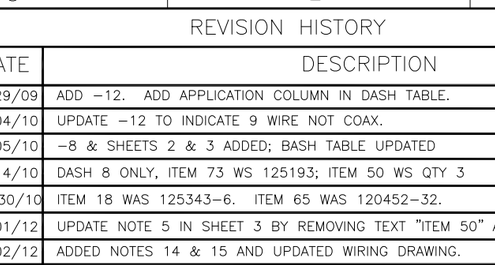
| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| J | 6746 | 6/29/09 | ADD −12. ADD APPLICATION COLUMN IN DASH TABLE. | SL |
| J1 | NONE | 2/04/10 | UPDATE −12 TO INDICATE 9 WIRE NOT COAX. | HT |
| K | 7095 | 2/05/10 | −8 & SHEETS 2 & 3 ADDED; BASH TABLE UPDATED | MSF |
| L | 7350 | 7/14/10 | DASH 8 ONLY, ITEM 73 WS 125193; ITEM 50 WS QTY 3 | K.D.H. |
| M | 8148 | 11/30/10 | ITEM 18 WAS 125343−6. ITEM 65 WAS 120452−32. | SL |
| M1 | 9213 | 2/01/12 | UPDATE NOTE 5 IN SHEET 3 BY REMOVING TEXT "ITEM 50" AFTER "DETECTOR". | SL |
| N | 8857 | 3/02/12 | ADDED NOTES 14 & 15 AND UPDATED WIRING DRAWING. | KRB |
| P | 9363 | 04/24/12 | UPDATE DVB/SCPC TUNER FAB. | SL |
| Q | 9555 | 04/25/12 | NEW FAB CORRECTED TRACE ROUTING FOR 70KHz MODEM IN P/N 124813−1 | MSF |
| R | 9803 | 6−21−12 | ITEM 72 WAS QTY 4; ADD ITEM 71 | K.D.H. |

NOTES, UNLESS OTHERWISE SPECIFIED:

1. APPLY ADHESIVE PER SEA TEL SPEC 121730.
2. LOCATE LABEL, APPROX. WHERE SHOWN.
3. INSTALLED JUMPERS:
   JP2 1−2
   JP3 SEE DASH TABLE
   JP4 1−2
4. IDENTIFY FPI PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX. WHERE SHOWN.
5. IDENTIFY ACU PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX. WHERE SHOWN.
6. IDENTIFY RECEIVER ASS'Y P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX. WHERE SHOWN.
7. IDENTIFY S/D CONVERTER PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX. WHERE SHOWN.
8. IDENTIFY DC / DC CONVERTER PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX. WHERE SHOWN.
9. IDENTIFY PER SEA TEL SPEC 122930 APPROX. WHERE SHOWN.
10. NOTE ORIENTATION OF IC & PCB AS SHOWN.
11. IDENTIFY DAC S/N PER SEA TEL SPEC 122930.
12. ALL PCB ASSY & REWORK SHALL COMPLY WITH IPC−A−610 REV. D.
13. PROGRAM & TEST PER SEA TEL SPEC 126883.
14. ROUTE ALL HARNESSES AND CABLE ASSEMBLIES PER SEA TEL SPEC. 121872.
15. PAGE 2, WIRE AS SHOWN IN PICTURE #1 FOR COSEL POWER SUPPLY, PICTURE #2 FOR THE MAEANWELL POWER SUPPLY; MAINTAINING WIRE SEPARATION AS INDICATED.

DASH TABLE

| DASH | APPLICATION | RECEIVER | ANTENNA | JP3 | SHEET # |
|---|---|---|---|---|---|
| −1 | TVRO | DVB | COAX | 2−3 | 2 |
| −2 | TXRX | DVB | 9 WIRE | 1−2 | 2 |
| −3 | TXRX | SCPC | 9 WIRE | 1−2 | 2 |
| −4 | USAT | SCPC | COAX | 2−3 | 2 |
| −6 | DAC | NBIF | 9 WIRE | 1−2 | 2 |
| −7 | DAC | NBIF | COAX | 2−3 | 2 |
| −8 | POLAR TRACK | 720MHz | 9 WIRE | 1−2 | 3 |
| −12 | TAC−C | DVB | 9 WIRE | 1−2 | 2 |




VIEW A−A
SCALE: 2:1
POWER SUPPLY CONNECTIONS

REFERENCE DRAWINGS:
126881 WIRING DIAGRAM, DAC 2202

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
X.X = ±.050
X.XX = ±.020
X.XXX = ±.005
ANGLES: ±.5°
INTERPRET TOLERANCING PER ASME Y14.5M − 1994

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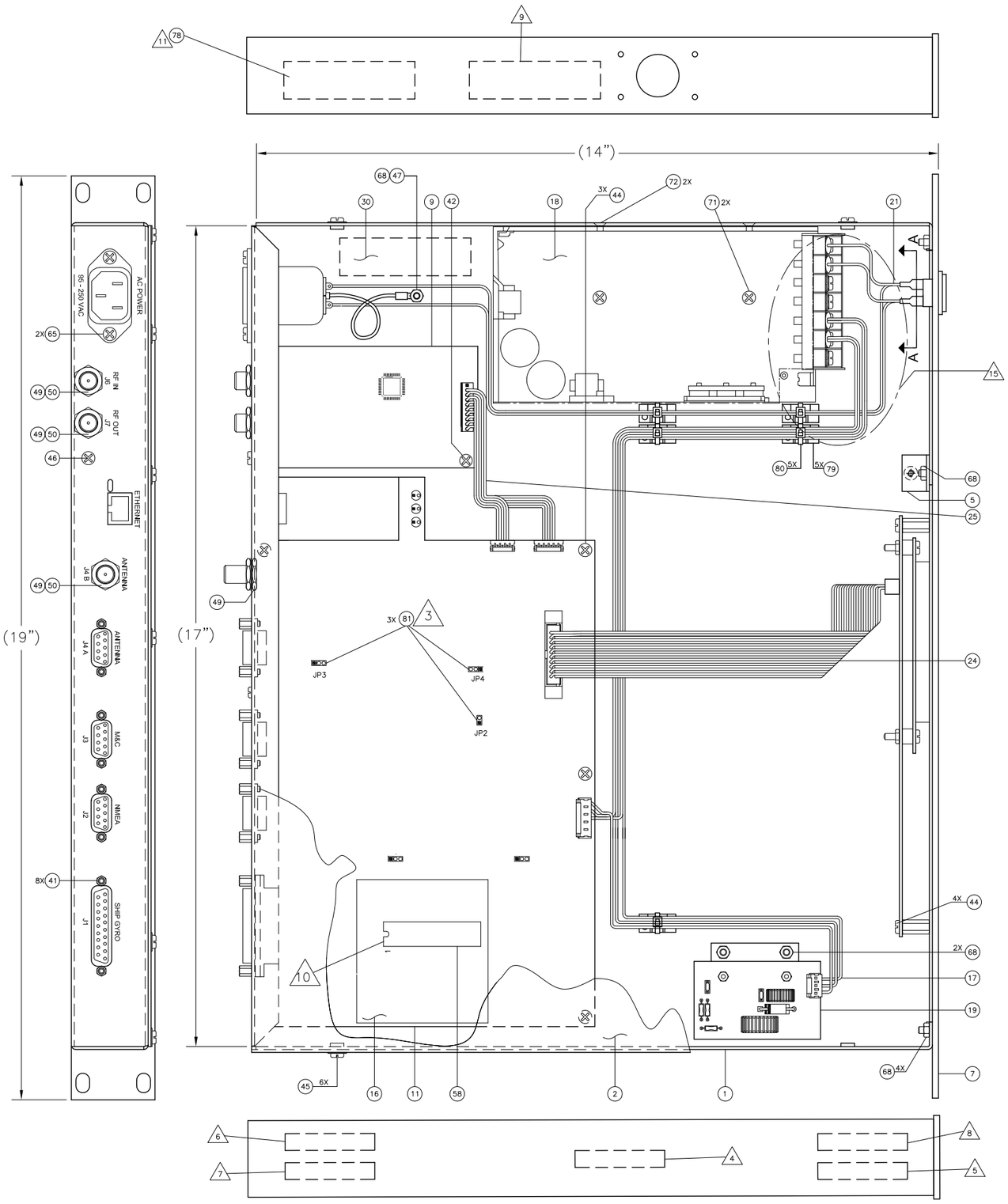
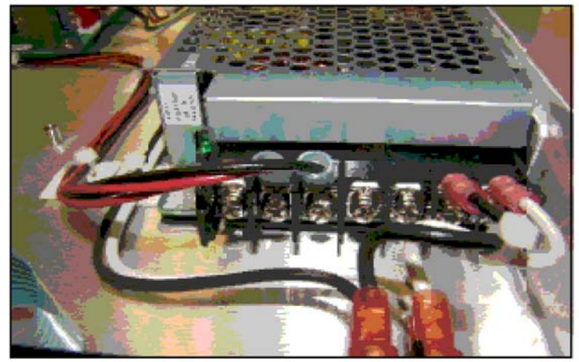
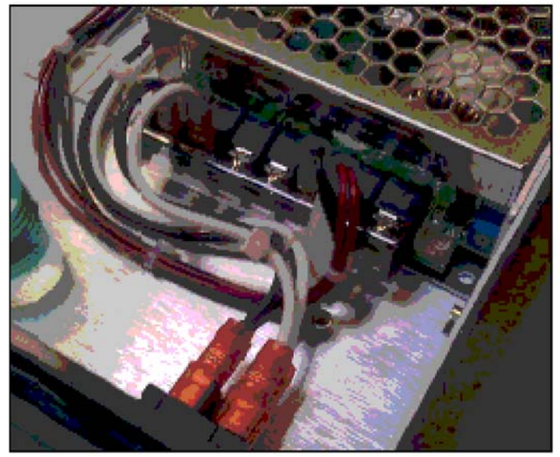
| | | | |
|---|---|---|---|
| DESIGNER/ENGINEER: | | DRAWN BY: LAE | Sea Tel COBHAM<br>Tel. 925−798−7979 Fax. 925−798−7986 |
| WEIGHT: | | DRAWN DATE: 5/17/08 | |
| MATERIAL: N/A | | APPROVED BY: | TITLE: DAC 2202 RACKMOUNT ASS'Y |
| FINISH: N/A | | APPROVED DATE: | |
| SURFACE ROUGHNESS: | SIZE: B | SCALE: NONE | DRAWING NUMBER: 125411 REV: R |
| 3rd ANGLE PROJECTION | FIRST USED: | | SHEET NUMBER 1 OF 3 |

DOCUMENT NO. 124225−4_A



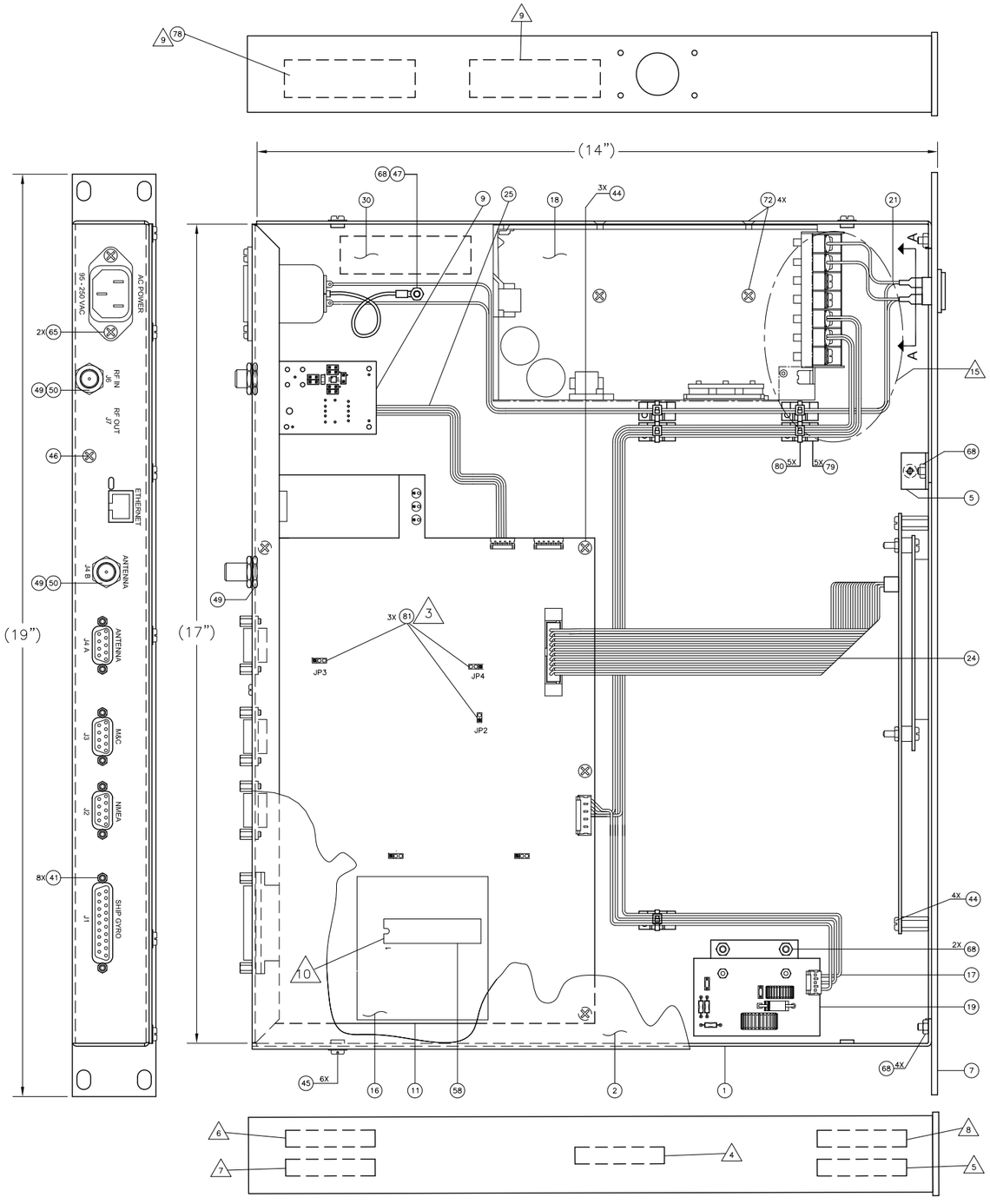
15 PICTURE 1

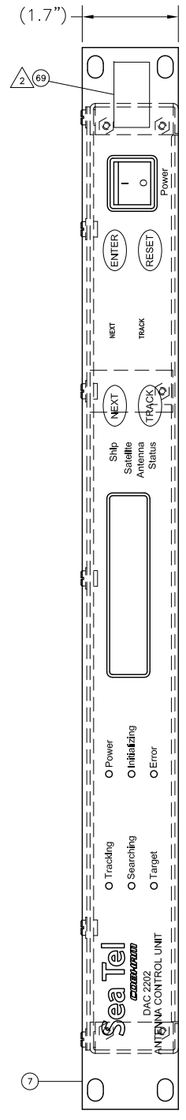


15 PICTURE 2

| SIZE | SCALE: | DRAWING NUMBER: | REV: |
|---|---|---|---|
| B | | 125411 | R |
| | | SHEET NUMBER: | 2 OF 3 |

DOCUMENT NO. 124225-4_A




REWORK INSTRUCTIONS

1. REMOVE TOP COVER OF A −2, −3 OR −6 DAC (125411).
2. REMOVE THE RECEIVER
3. INSTALL A PANEL NUT (ITEM 49) ON TO DETECTOR (ITEM 9), THREAD DOWN TO PCB.
4. CONNECT CABLE (ITEM 25) TO DETECTOR.
5. INSTALL THE WIDE BAND DETECTOR INTO THE DAC FROM THE INSIDE.
6. INSTALL WASHER & PANEL NUT ONTO THE "F" CONNECTOR TO SECURE THE DETECTOR INTO THE DAC. APPLY LOCTITE PER SEATEL SPEC. 121730 & TORQUE PER SEATEL SPEC. 122305.
7. CONNECT THE REMAINING END OF THE CABLE (ITEM 25) TO THE MAIN DAC MOTHER BOARD (ITEM 11).
8. RE−ATTACH THE TOP COVER (ITEM 2).
9. LOAD SOFTWARE 132594.
10. TEST PER SEATEL SPEC. 126883.
11. ALL ASS'Y & REWORK SHALL COMPLY WITH IPC−A−610D.

# DASH -8 ONLY

| SIZE | SCALE: | DRAWING NUMBER: | REV: |
|---|---|---|---|
| B | | 125411 | R |
| | | SHEET NUMBER: 3 OF 3 | |

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 133008 | B1 | GENERAL ASS'Y, 4009-91, MK2 | |
| 2 | 1 EA | 129165-1 | D | RADOME ASS'Y, GA INSTALL, 50 IN, TX/R | |
| 4 | 1 EA | 132345-1 | A2 | SSPB, KU, 8W, CODAN MINI BUC, 13.75 T | |
| 5 | 2 EA | 127386-2 | A4 | LNB, SMW, QUAD LO, KU BAND, TYPE F | |
| 6 | 1 EA | 125411-3 | Q | DAC-2202, SCPC RCVR, 9 WIRE IF | (NOT SHOWN) , |
| 7 | 1 EA | 129615-1 | B | BELOW DECK KIT, L-BAND, 400MHZ, RS-23 | (NOT SHOWN) , |
| 8 | 1 EA | 130929-1 | A2 | BALANCE WEIGHT KIT, FEED | (NOT SHOWN) , |
| 9 | 1 EA | 131140 | B | CUSTOMER DOC PACKET, SERIES 09 KU-BAN | (NOT SHOWN) , |
| 11 | 1 EA | 124747-1 | C | DECAL KIT, SEATEL, 50/60 IN DOMES | (NOT SHOWN) , |
| 12 | 1 EA | 121711 | A | BALANCE WEIGHT KIT | (NOT SHOWN) , |
| 13 | 1 EA | 130290-1 | B1 | SHIP STOWAGE KIT, XX09 | (NOT SHOWN) , |

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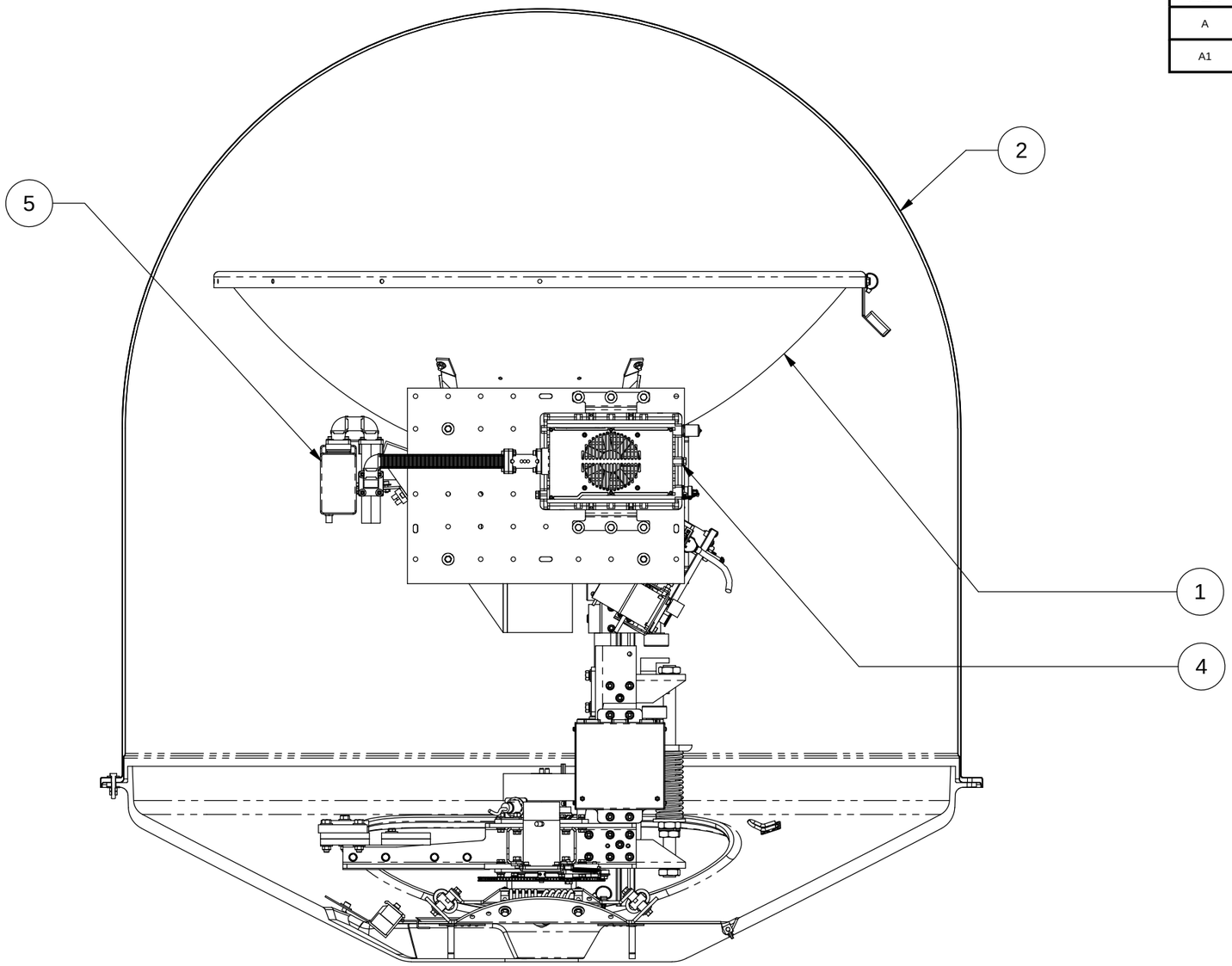
SYSTEM, 4009-91, MK2, LIN, 8W, QUAD, 50 IN

| PROD FAMILY | EFF. DATE | SHT | DRAWING NUMBER | REV |
|---|---|---|---|---|
| 4009 | 5/24/2012 | 1 OF 1 | 133007-601 | A1 |

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| A | 8051 | 09/28/10 | RELEASED TO PRODUCTION. WAS REVISION X1. | KRB |
| A1 | N/A | 01/27/11 | ADDED DASH 606. | KRB |




| NON-ZERO QTY BOMS | | | | | |
|---|---|---|---|---|---|
| DASH | POL | WATT | RF MFR | LNB | OTHER |
| -601 | LIN | 8W MINI | CODAN | QUAD | |
| -606 | LIN | 8W MINI | CODAN | NONE | |

REFERENCE DRAWINGS;
133005 ANTENNA SYSTEM SCHEMATIC
133006 SYSTEM BLOCK DIAGRAM
131790 PEDESTAL SCHEMATIC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
X.X = ±.050
X.XX = ±.020
X.XXX = ±.005
ANGLES: ±.5°
INTERPRET TOLERANCING PER ASME Y14.5 - 2009

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DESIGNER/ENGINEER:
WEIGHT:
MATERIAL: N/A
FINISH: N/A
SURFACE ROUGHNESS:
3rd ANGLE PROJECTION

DRAWN BY: KRB
DRAWN DATE: 09/03/10
APPROVED BY:
APPROVED DATE:
SIZE: B
SCALE: 1:8
FIRST USED: 4009

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COBHAM
Tel. 925-798-7979 Fax. 925-798-7986

TITLE:
SYSTEM, 4009-91, MK2
50 INCH RADOME

DRAWING NUMBER: 133007
REV: A1
SHEET NUMBER: 1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 133008 | B1 | GENERAL ASS'Y, 4009-91, MK2 | |
| 4 | 1 EA | 128043-2 | H1 | FEED ASS'Y, 4009, KU-BAND | |
| 5 | 0 EA | 127386-X | | (REF ONLY) LNB, SMW, KU BAND, DUAL/TR | SEE FACTORY ORDER , |
| 5 | 0 EA | 122188-X | | (REF ONLY) LNB, KU-BAND, NJRC, TYPE F | SEE FACTORY ORDER , |
| 6 | 0 EA | 132345-1 | A2 | SSPB, KU, 8W, CODAN MINI BUC, 13.75 T | |
| 20 | 1 EA | 115708-1 | L | CIRCUIT BREAKER BOX ASS'Y, 220V | |
| 21 | 1 EA | 131057-1 | F | ENCLOSURE ASS'Y, PCU, 09G2, 3 CH, 232 | |
| 22 | 1 EA | 131227-1 | C | ENCLOSURE ASS'Y, MOTOR DRIVER, 09G2 | |
| 23 | 1 EA | 121951-3 | F1 | MOTOR, SZ 23, BLDC, 2 STK W/ ENCODER, | |
| 24 | 2 EA | 125644-1 | H1 | MOTOR, SIZE 23, BLDC W/ BRAKE, 15 PIN | |
| 25 | 1 EA | 125570-2 | L3 | POWER SUPPLY ASS'Y, 150W, RH ENTRY, N | |
| 26 | 1 EA | 131381-1 | C | GPS ANTENNA, SERIAL | |
| 27 | 1 EA | 129543-24 | C | KIT, CABLE ASS'Y AND PROXIMITY SENSOR | |
| 31 | 1 EA | 129526-84 | C | HARNESS ASS'Y, PCU TO MOTOR DRIVER, X | |
| 32 | 1 EA | 129527-36 | B | HARNESS ASS'Y, MOTOR TO ELEVATION, 36 | |
| 33 | 1 EA | 131493-1 | A2 | HARNESS ASS'Y, REFLECTOR, G2, XX09/XX | |
| 34 | 1 EA | 132917-84 | A | CABLE ASS'Y, 24VDC TO CODAN MINI SSPB | |
| 40 | 1 EA | 129254-2 | A3 | POWER RING, 20A, 3 CIRCUITS, XX09 | |
| 41 | 1 EA | 127583-64 | A1 | CABLE ASSEMBLY, PEDESTAL, AC POWER, 4 | |
| 43 | 2 EA | 124288-24 | H | CABLE ASS'Y, AC POWER, 24 IN | |
| 51 | 2 EA | 114972-4 | N | CABLE ASS'Y, SMA(M) - SMA(M), 30 IN | |
| 52 | 1 EA | 114972-3 | N | CABLE ASS'Y, SMA(M) - SMA(M), 84 IN | |
| 53 | 1 EA | 111079-8 | G1 | CABLE ASS'Y, SMA(M)-N(M), 8 FT. | |
| 54 | 1 EA | 113303-10 | V | CABLE ASS'Y, SMA 90 - SMA (M), 9 IN | |
| 55 | 1 EA | 128001-60YEL | A2 | CABLE ASS'Y, RG-179 COAX, F(M) TO SMA | |
| 56 | 1 EA | 128001-60ORG | A2 | CABLE ASS'Y, RG-179 COAX, F(M) TO SMA | |
| 60 | 2 EA | 115492-1 | C8 | ADAPTER, N(F)-SMA(F), W/FLANGE | |
| 61 | 1 EA | 116466 | F1 | ROTARY JOINT, 4.5 GHz, DUAL COAX. | |

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SYSTEM BLOCK DIAGRAM, 4009-91, MK2

| PROD FAMILY LIT | EFF. DATE 5/24/2012 | SHT 1 OF 2 | DRAWING NUMBER 133006-1 | REV B |
|---|---|---|---|---|

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 70 | 1 EA | 128059 | B1 | FILTER, TX REJECT, WR-75, 13.75-14.5 | |
| 71 | 1 EA | 126144-1 | D1 | WAVEGUIDE, WR-75, 180 DEG E-BEND | |
| 80 | 1 EA | 127280-2 | A2 | WAVEGUIDE FILTER, KU-BAND, RX/REJECT, | |
| 81 | 1 EA | 132633-2 | A2 | WR-75, E-H BEND W/FLEX, 1.33 X 1.37 X | |
| 82 | 1 EA | 125157-1 | A1 | DIPLEXER, DPX75K-002, WR-75 | |
| 83 | 1 EA | 128716-1 | A1 | WAVEGUIDE, WR-75, KU BAND, 4006RZA | |
| 84 | 1 EA | 128290-1 | A | WAVEGUIDE, WR-75, 180 DEG H-BEND W/BR | |
| 85 | 1 EA | 115477-6 | C | WAVEGUIDE, WR-75, ROTARY JOINT, L-STY | |
| 100 | 1 EA | 125411-3 | Q | DAC-2202, SCPC RCVR, 9 WIRE IF | |
| 101 | 1 EA | 129615-1 | B | BELOW DECK KIT, L-BAND, 400MHZ, RS-23 | |
| 102 | 1 EA | 129710-1 | B2 | BASE MUX RACK PANEL ASS'Y, 400MHZ, RS | |
| 103 | 1 EA | 121628-4 | R | ASSEMBLY, TERMINAL MOUNTING STRIP | |
| 105 | 1 EA | 129613-2 | E1 | MODEM ASS'Y, 400MHZ FSK, 3 CH, BDE, R | |
| 110 | 1 EA | 113303-10 | V | CABLE ASS'Y, SMA 90 - SMA (M), 9 IN | |
| 111 | 1 EA | 115384-3 | E2 | CABLE ASS'Y, SMA(M)-BNC(M), 72 IN. | |
| 112 | 1 EA | 111115-6 | B1 | CABLE ASS'Y, F(M)-F(M), 6 FT. | 75 OHM SATELLITE MODEM , |
| 112 | 1 EA | 116700-6 | F | CABLE ASS'Y, RG223, N(M)-F(M), 6 FT. | 50 OHM SATELLITE MODEM , |
| 114 | 1 EA | 114973-72 | F | CABLE ASS'Y, N(M)-N(M), 72 IN. | 50 OHM SATELLITE MODEM , |
| 114 | 1 EA | 116700-6 | F | CABLE ASS'Y, RG223, N(M)-F(M), 6 FT. | 75 OHM SATELLITE MODEM , |
| 120 | 1 EA | 115492-1 | C8 | ADAPTER, N(F)-SMA(F), W/FLANGE | |
| 121 | 1 EA | 110567-19 | C1 | ADAPTER, N(F)-N(F), STRAIGHT, FLANGE | |
| 122 | 1 EA | 111003-18 | C | ADAPTER, BNC(F)-F(M) | |
| 130 | 1 EA | 116298-1 | G | INTERFACE HARNESS ASS'Y, SINGLE MODEM | |
| 131 | 1 EA | 120643-25 | B | CABLE ASS'Y, RS232, 9-WIRE, STRAIGHT, | |

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SYSTEM BLOCK DIAGRAM, 4009-91, MK2

| PROD FAMILY LIT | EFF. DATE 5/24/2012 | SHT 2 OF 2 | DRAWING NUMBER 133006-1 | REV B |
|---|---|---|---|---|

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 132 | 1 EA | 120643-6 | B | CABLE ASS'Y, RS232, 9-WIRE, STRAIGHT, | |
| 133 | 1 EA | 119479-10 | B1 | CABLE ASS'Y, CAT5 JUMPER, 10 FT. | |
| 134 | 1 EA | 126877 | C1 | HARNESS ASS'Y, COMTECH MODEM INTERFAC | COMTECH MODEM , |
| 134 | 1 EA | 119478-5 | D | CABLE ASS'Y, RJ-45 SERIAL, 60 IN. | IDIRECT MODEM , |

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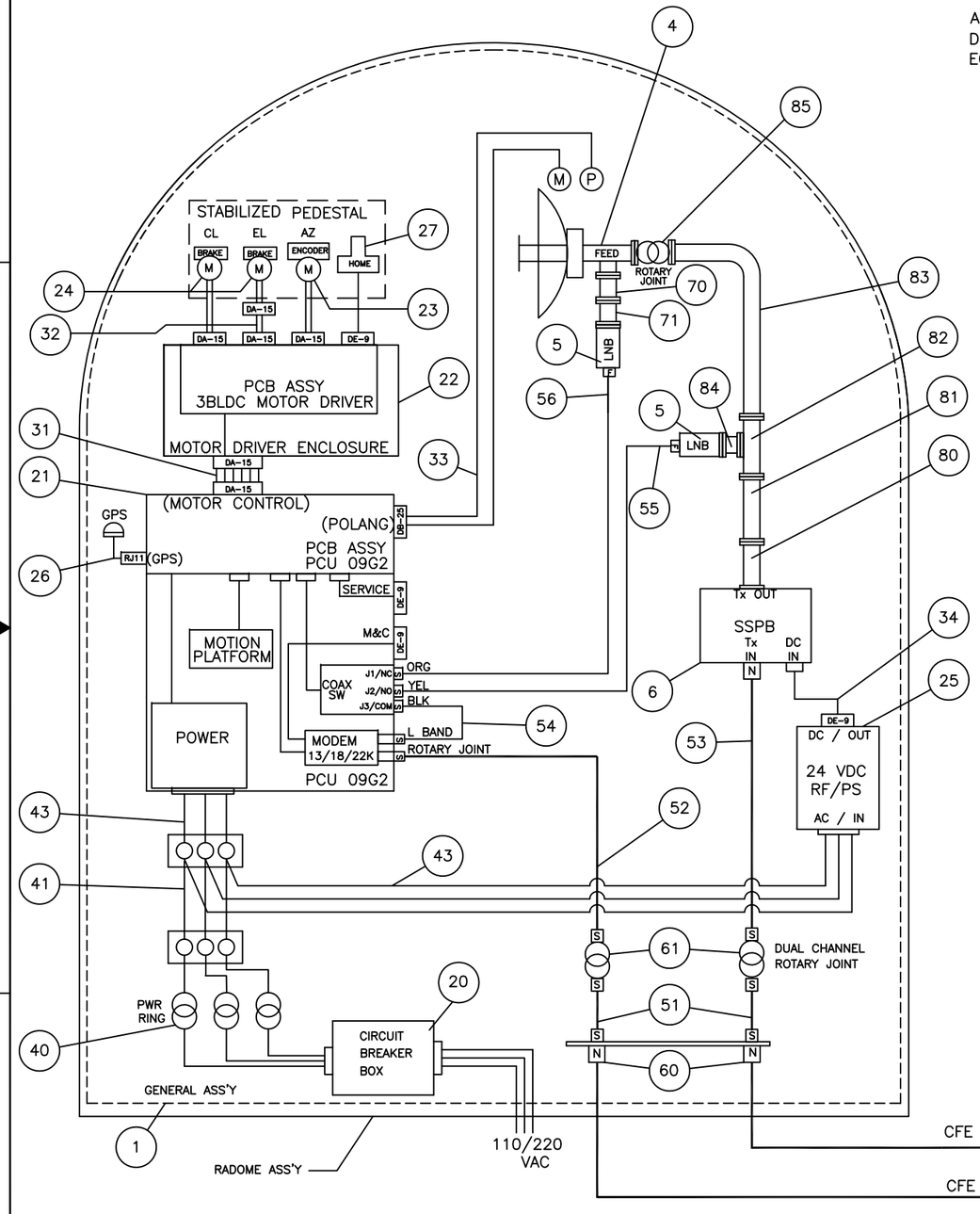
SYSTEM BLOCK DIAGRAM, 4009-91, MK2

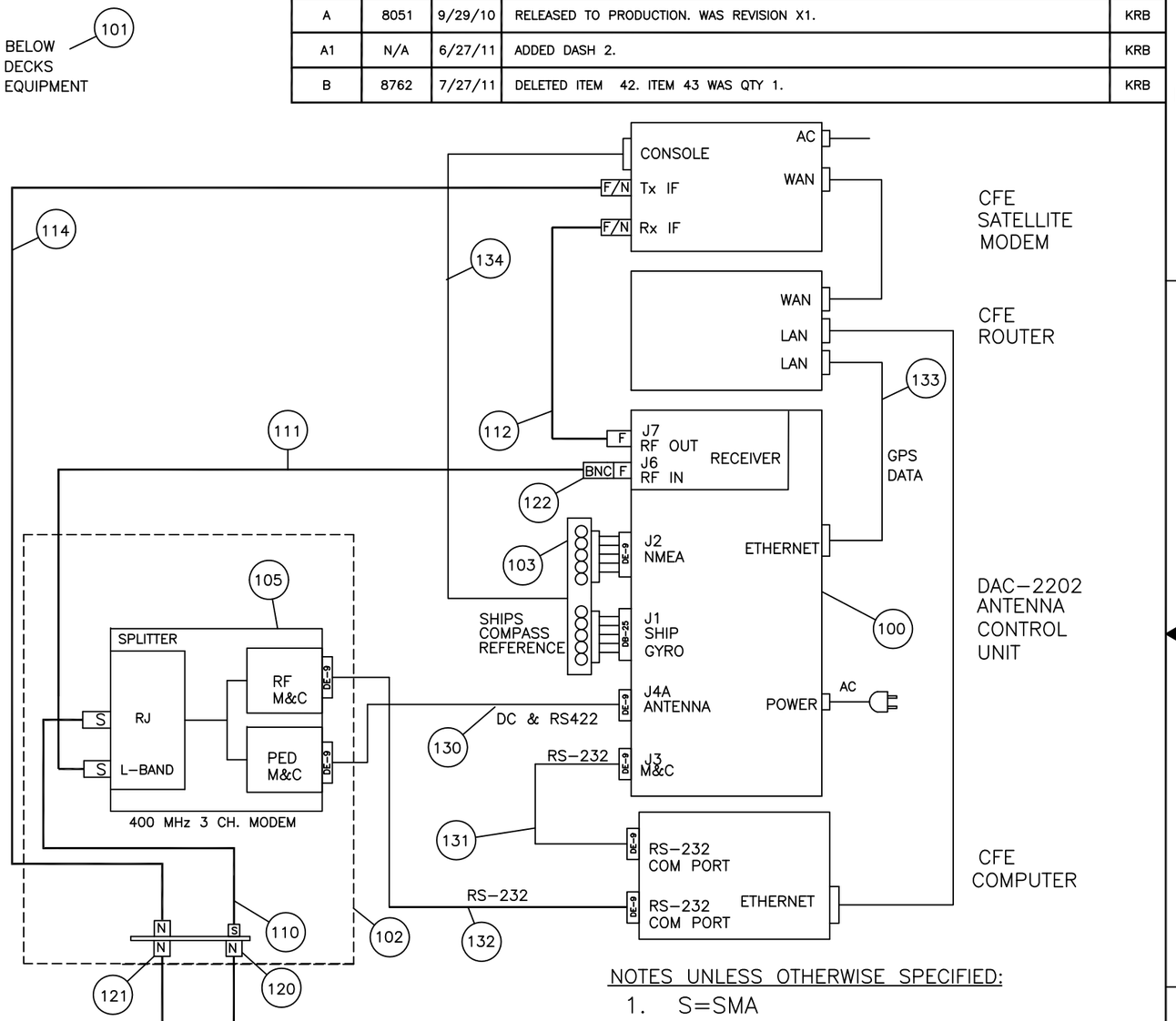
| PROD FAMILY LIT | EFF. DATE 5/24/2012 | SHT 3 OF 2 | DRAWING NUMBER 133006-1 | REV B |
|---|---|---|---|---|

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| A | 8051 | 9/29/10 | RELEASED TO PRODUCTION. WAS REVISION X1. | KRB |
| A1 | N/A | 6/27/11 | ADDED DASH 2. | KRB |
| B | 8762 | 7/27/11 | DELETED ITEM 42. ITEM 43 WAS QTY 1. | KRB |




ABOVE DECKS EQUIPMENT

BELOW DECKS EQUIPMENT




NOTES UNLESS OTHERWISE SPECIFIED:

1. S=SMA

| DASH # | SYSTEM |
|---|---|
| –1 | 4009–91, MK2 |
| –2 | 5009–91, MK2 |

REFERENCE DRAWINGS

133005 SCHEMATIC, ANTENNA SYSTEM
131790 SCHEMATIC, ANTENNA PEDESTAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
<48" = ± 1"
<15' = ± 2"
<100' = ± 4"
>100' = ± 6"
INTERPRET TOLERANCING PER ASME Y14.5M – 1994

MATERIAL: N/A

FINISH: N/A

3rd ANGLE PROJECTION

DRAWN BY: KRB

DRAWN DATE: 09/03/10

APPROVED BY:

APPROVED DATE:

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COBHAM
Tel. 925–798–7979 Fax. 925–798–7986

TITLE: SYSTEM BLOCK DIAGRAM XX09–91, MK2

SIZE: B

SCALE: NONE

DRAWING NUMBER: 133006

REV: B

FIRST USED: 4009

SHEET NUMBER: 1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 131829-1 | A | RADOME ASS'Y, 50 IN, TUNED, WHITE | |
| 4 | 1 EA | 130390-1 | B | KIT, HARDWARE, GA TO RADOME, STD | |
| 5 | 2 EA | 119801-012 | B | CABLE TIE, NYLON, 4 IN, NATURAL | |
| 6 | 1 EA | 111679-7 | B | CABLE CLAMP, NYLON, .50 DIA, #8 MTG H | |
| 8 | 1 EA | 111679-25 | B | CABLE CLAMP, NYLON, 3/4 DIA, #10 MTG | |
| 9 | 1 EA | 111679-5 | B | CABLE CLAMP, NYLON, .375 DIA, #8 MTG | |
| 10 | 1 OZ | 125948-1 | A | ADHESIVE, HOT MELT, 3M SCOTCH-WELD 37 | (NOT SHOWN) |
| 14 | 1 EA | 130394-1 | C | KIT, HARDWARE, RADOME TO MAST, 50 IN | SEE NOTES |
| 20 | 5 EA | 124903-1 | B2 | STRAIN RELIEF ASS'Y | SEE NOTES |
| 51 | 11 EA | 114580-230 | | WASHER, FLAT, M4, S.S. | |
| 52 | 8 EA | 125806-7 | A | ROTALOC HEX NUT, SS-1-B38-M4 X 07-6H | |
| 53 | 4 EA | 119745-218 | | SCREW, PAN HD, PHIL, M4 x 8 | |
| 54 | 4 EA | 119745-216 | | SCREW, PAN HD, PHIL, M4 X 6, S.S. | |
| 56 | 4 EA | 114589-141 | | SCREW, HEX HD M6X35 | |
| 57 | 8 EA | 130371-170 | A | WASHER, NYLON, 6.4 ID, 12 OD | |
| 58 | 8 EA | 120089-251 | | NUT, HEX, M6, S.S. | |
| 99 | 1 EA | 131226 | | PROCEDURE, RADOME STRAIN RELIEF INSTA | BAG WITH ITEM 20 |
| 100 | 9 EA | 119801-019 | B | CABLE TIE, NYLON, 7.5 IN, NATURAL | |

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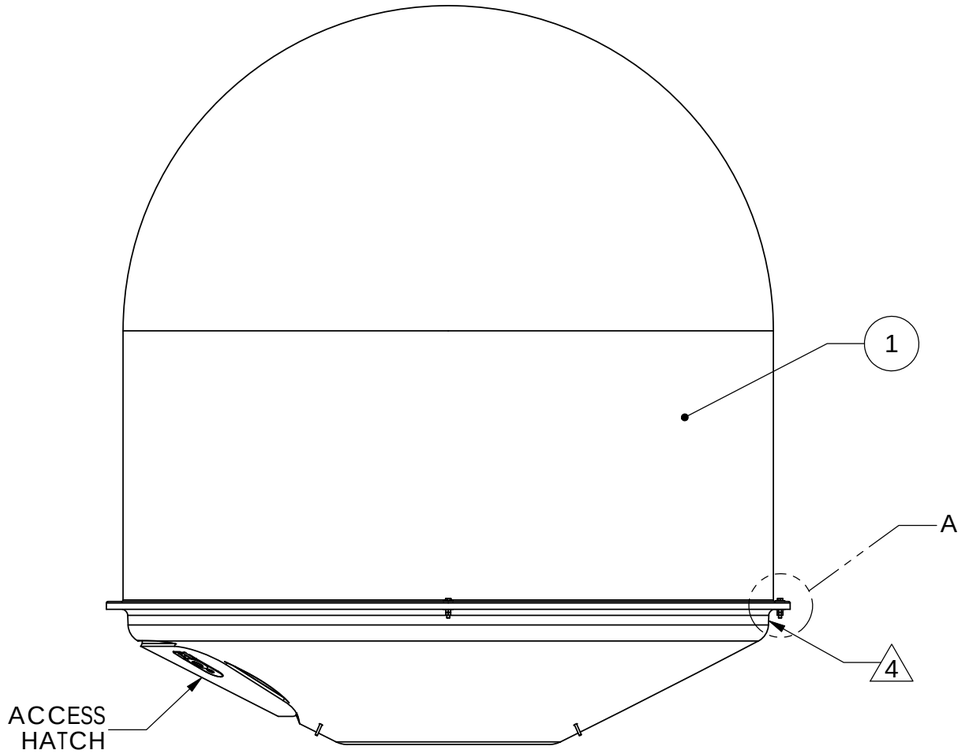
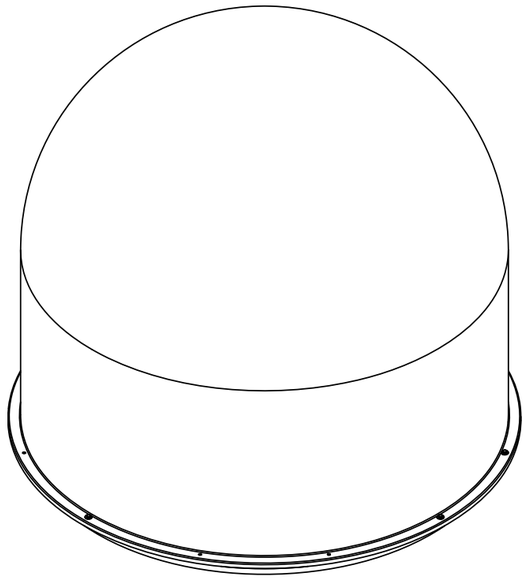
RADOME ASS'Y, GA INSTALL, 50 IN, TX/RX, WHITE

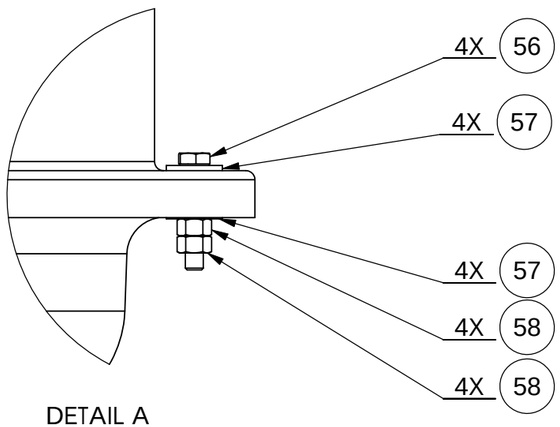
| PROD FAMILY | EFF. DATE | SHT 1 OF 2 | DRAWING NUMBER | REV |
|---|---|---|---|---|
| COMMON | 7/8/2010 | | 129165-1 | D |

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| A | N/A | 7/13/09 | RELEASED TO PRODUCTION. | LW |
| B | 6911 | 10/05/09 | DEL ITEM 7; ITEM 10 WS ITEM 8; ITEM 5 WS QTY10; ITEM 51 QTY WS 7; ITEM 52 QTY WS 7; ITEM 53 QTY WS 7; ADDED ITEMS 8, 9, 20, 54, 99; ADDED NOTES 4, 5, 6. | AMN |
| B1 | 6920 | 10-20-09 | ADD BOMs: -2 TO -7 AND DASH TABLE. | HT |
| B2 | 7075 | 2-24-10 | DASH 1 ONLY, DOOR LATCHES WAS BLACK, CHANGED TO WHITE. | K.D.H. |
| C | 7099 | 03-04-10 | ITEM 1 WAS 128650-1 REMOVE ITEM 2 AND NOTE 6. | SL |
| D | 7167 | 05-07-10 | UPDATE VIEWS IN SHT 2. | SL |



| DASH | DESCRIPTION |
|---|---|
| -1 | WHITE |
| -2 | FRENCH NAVY GREY |
| -3 | IRISH NAVY GREY |
| -4 | DANISH NAVY GREY |
| -5 | GREY RAL 7001 |
| -6 | WINDOW GREY RAL 7004 |
| -7 | OYSTER WHITE |




DETAIL A
SCALE 1 : 2

HARDWARE SHOWN
IS FOR TRANSIT ONLY.
REMOVE AND REPLACE
WITH KIT 130394-1
AT FINAL INSTALLATION.

NOTES: UNLESS OTHERWISE SPECIFIED

1. APPLY ADHESIVE PER SEA TEL SPEC. 121730.
2. TORQUE THREADED FASTENERS PER SEA TEL SPEC. 122305.
3. ROUTE ALL HARNESS AND CABLES ASSEMBLIES PER SEA TEL SPEC. 121872.

4 BOW MARKER LOCATION DIRECTLY ACROSS FROM ACCESS HATCH.

5 BAG AND ATTACH TO INSIDE OF RADOME.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS.
X = ±1.50
X.X = ±0.50
X.XX = ±0.15
ANGLES: ±.5°
INTERPRET TOLERANCING PER ASME Y14.5M - 1994

MATERIAL: N/A

FINISH: N/A

3rd ANGLE PROJECTION

DRAWN BY: LW

DRAWN DATE: 7/10/09

APPROVED BY:

APPROVED DATE:

SIZE: B

SCALE: NA

FIRST USED: 4009

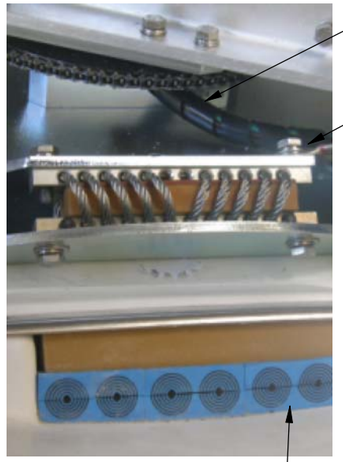
Sea Tel
COBHAM
Tel. 925-798-7979 Fax. 925-798-7986

TITLE: RADOME ASS'Y, GA INSTALL, TX/RX, 50 IN

DRAWING NUMBER: 129165

REV: D

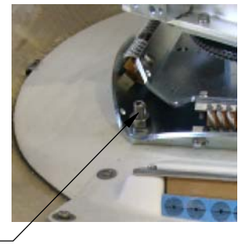
SHEET NUMBER: 1 OF 2



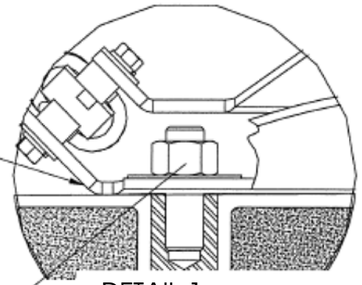
POSITION GAWITH CABLE EXIT TOWARDS CABLE PASS-THRU PLATE

ROUTE CABLES AS SHOWN

CABLE PASS THRU ASS'Y



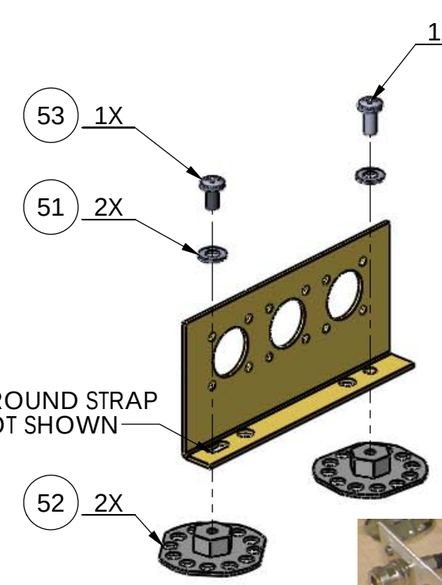
DETAIL J
(4 PLACES)

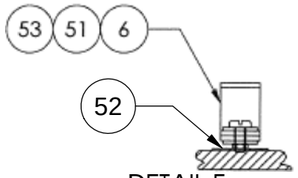


GENERAL ASS'Y (GA) BASE PLATE

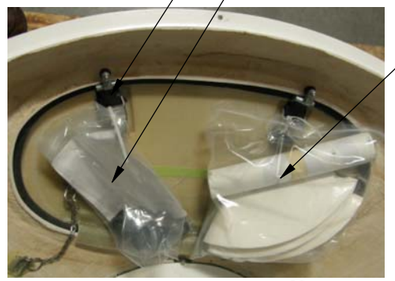
4X M12 X 60 SET SCREW
4X 1/2 FENDER WASHER
4X M12 HEX NUT
P/O ITEM 4.

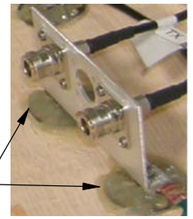
DETAIL J
GENERAL ASSEMBLY (GA) ATTACHMENT




DETAIL F



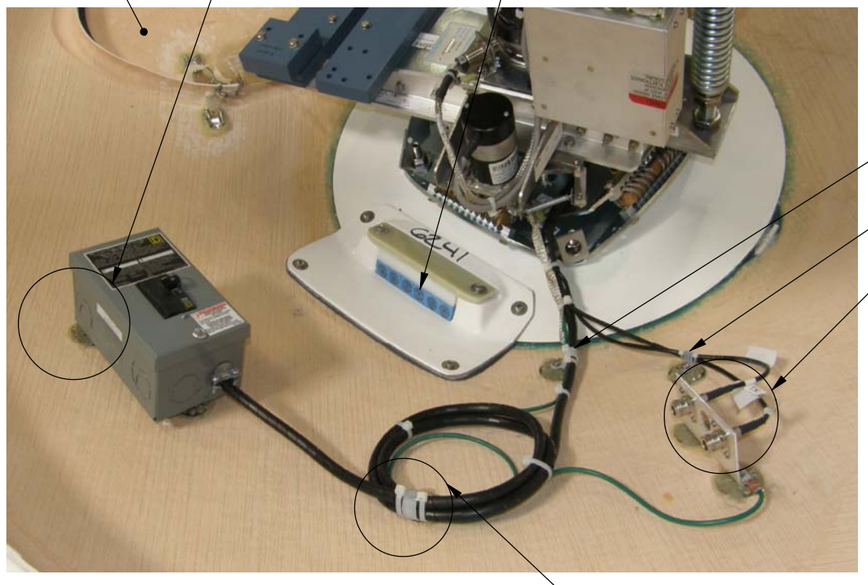



DETAIL D

APPLY SUFFICIENT AMOUNT OF ITEM 10 (AS SHOWN).

RADOME DOOR/HATCH (AFT)

SEE DETAIL H (3 PLACES)

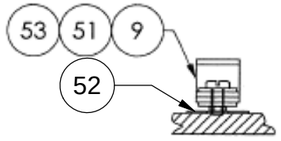


SEE DETAIL F

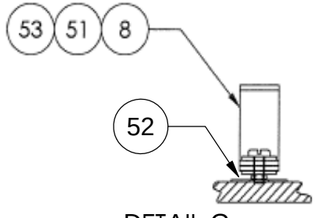
SEE DETAIL E

SEE DETAIL D

SEE DETAIL G



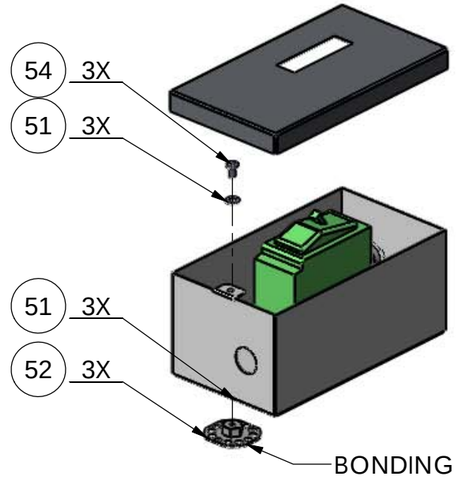

DETAIL E




DETAIL G

2X 5
CABLE DRESSING
3 PLACES

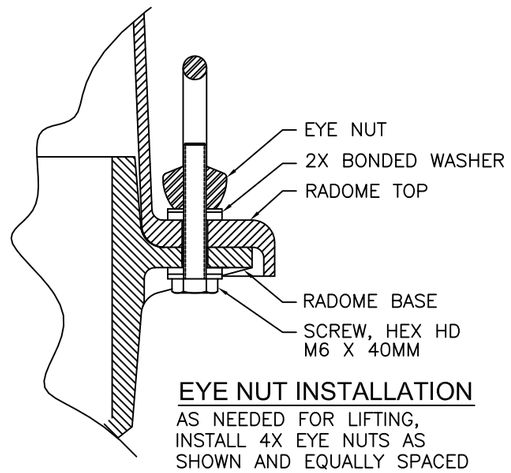
8 PLACES: PRIOR TO FINAL ASSEMBLY USE ADHESIVE (ITEM 10) TO ADHERE BONDING FASTENERS (ITEM 52) TO RADOME BASE IN APPROX. LOCATIONS SHOWN. MAKE SURE THERE IS NO INTERFERENCE WITH GA.




DETAIL H

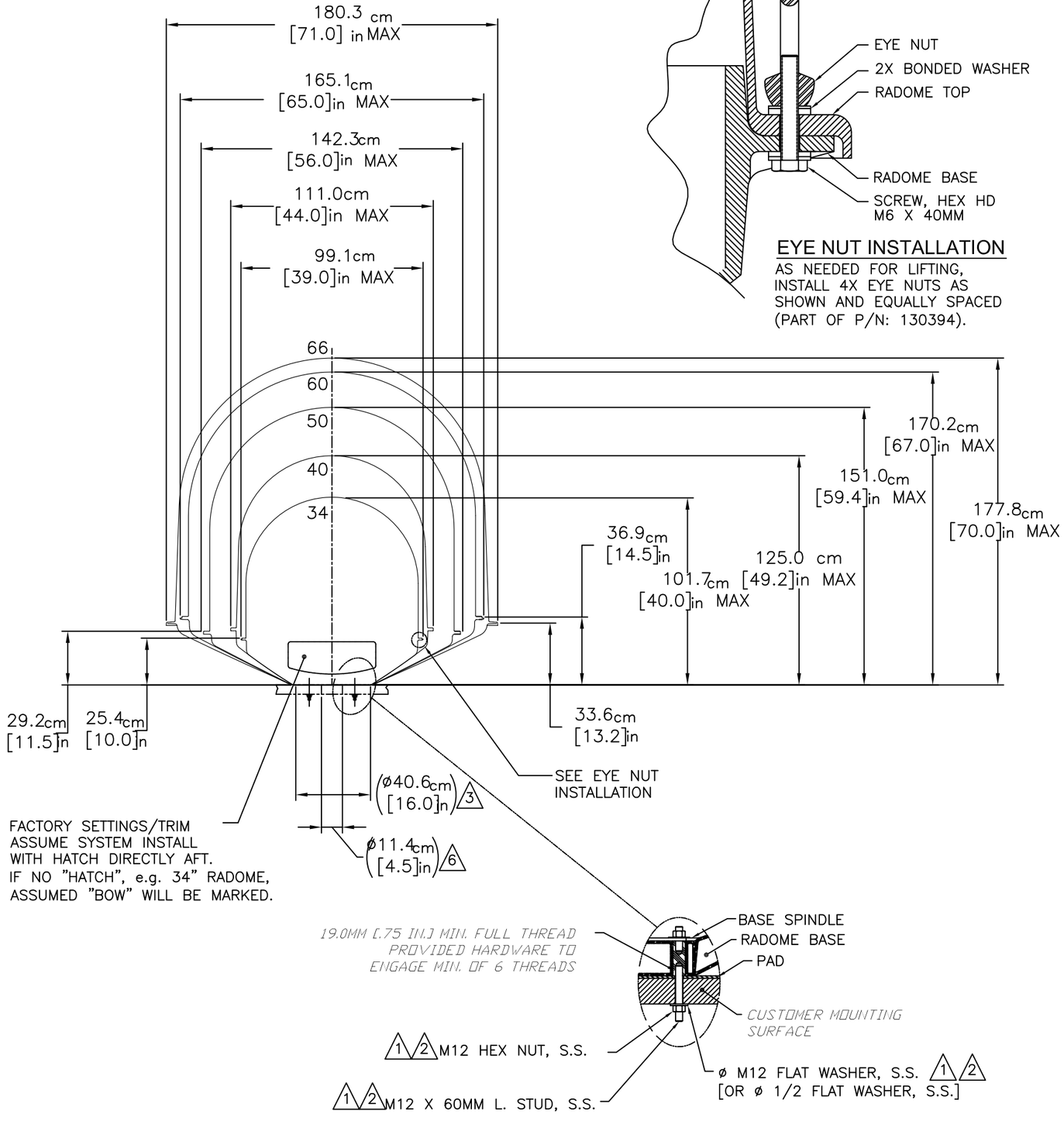
| SIZE | SCALE: | DRAWING NUMBER | REV |
|---|---|---|---|
| B | 1:33.3 | 129165 | D |
| | | SHEET NUMBER 2 OF 2 | |

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| A | N/A | 9/16/09 | ADDED 50–IN OUTLINE, NOTE 5; RELEASED TO PRODUCTION; REV WS X1. | AMN |
| B | N/A | 1/28/10 | ADDED 4.5 IN DIA PREFERRED CABLE PASSAGE CUTOUT (ZONE C3); ADDED NOTE 6. | AMN |
| B1 | N/A | 1/12/12 | ADDED 40 IN SMOOTH BASE RADOME. | KRB |



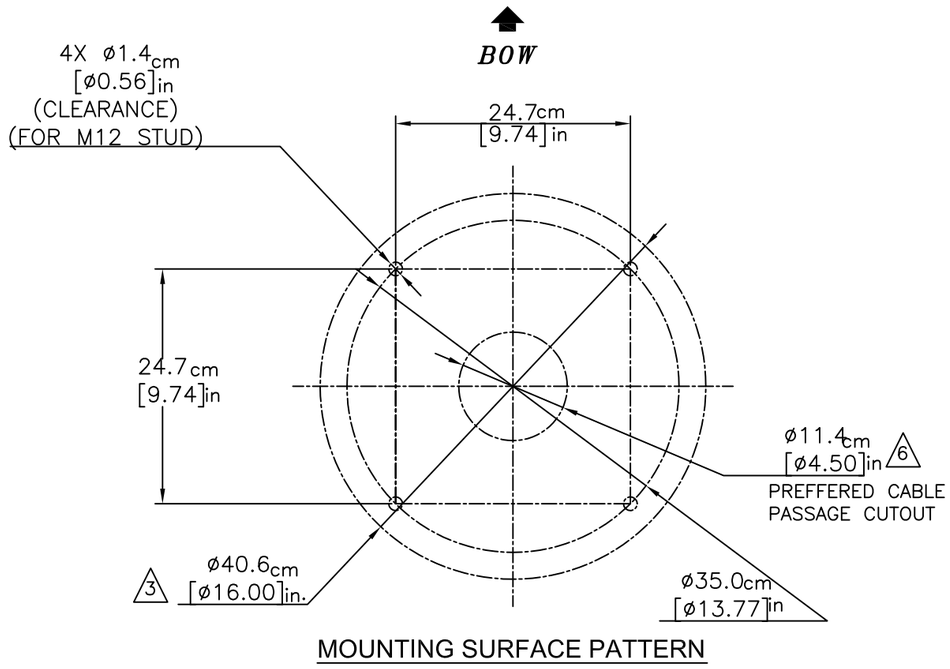

EYE NUT INSTALLATION

AS NEEDED FOR LIFTING, INSTALL 4X EYE NUTS AS SHOWN AND EQUALLY SPACED (PART OF P/N: 130394).





19.0MM [.75 IN.] MIN. FULL THREAD
PROVIDED HARDWARE TO
ENGAGE MIN. OF 6 THREADS
BASE SPINDLE
RADOME BASE
PAD
CUSTOMER MOUNTING SURFACE
1 2 M12 HEX NUT, S.S.
1 2 M12 X 60MM L. STUD, S.S.
ø M12 FLAT WASHER, S.S. 1 2
[OR ø 1/2 FLAT WASHER, S.S.]




MOUNTING SURFACE PATTERN

NOTES: UNLESS OTHERWISE SPECIFIED

1. INDICATED ITEMS ARE PART OF MOUNTING KIT P/N: 130394.
2. APPLY ADHESIVE PER SEATEL SPEC. 121730. LOCTITE 271 (RED) PROVIDED WITH MOUNTING KIT, P/N 130394.
3. MINIMUM DIAMETER OF MAST MOUNTING PLATE EQUAL TO RADOME BASE DIAMETER.
4. REFER TO DOC. NO. 130040 FOR INSTALLATION GUIDELINES.
5. DIMENSIONS ARE IN CENTIMETERS, [INCHES IN PARENTHESES], TOLERANCE +/– .5MM.
6. ENSURE CABLE PASSAGE CUTOUT EDGES HAVE NO SHARP EDGES, TO PROTECT CABLE.

REFERENCE DRAWINGS

129461 RADOME ASS'Y, 66–IN
130340 RADOME ASS'Y, 60–IN
129165 RADOME ASS'Y, 50–IN
131750 RADOME ASS'Y, 40–IN
125808 RADOME ASS'Y, 34–IN

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS.
X = ±1.50
X.X = ±0.50
X.XX = ±0.15
ANGLES: ±.5°
INTERPRET TOLERANCING PER ASME Y14.5M – 1994

MATERIAL: N/A

FINISH: N/A

DRAWN BY: HIEP T.

DRAWN DATE: 05–28–09

APPROVED BY:

APPROVED DATE:

SIZE: B

SCALE: N/A

DRAWING NUMBER: 130450

REV: B1

3rd ANGLE PROJECTION

FIRST USED: XX06

SHEET NUMBER: 1 OF 1

Sea Tel
COBHAM
Tel. 925–798–7979 Fax. 925–798–7986

TITLE: RADOME INSTALLATION ARRANGEMENT

DOCUMENT NO. 124225–4_A

**1.0 Purpose.** To define the installation procedure for installing strain reliefs in "smooth base" radomes.

**2.0 Scope.** This installation procedure applies to fiberglass radomes having Sea Tel's standard four-hole mounting pattern, and M12 mounting hardware, in the 80-180 cm (34-66 in) nominal size range, typically referred to as "smooth" base radomes. It also applies to our larger 193 cm (76-inch) radome having a twelve-hole mounting pattern. It is to be used where the preferred center cable exit may not be desired.

**3.0 Tools/materials.**

1. Electric drill.
2. Small drill bit 1/8" dia. (3-4mm dia.).
3. Hole saw, 1 3/8" dia. (35 mm), with mandrel and ¼" dia. pilot drill.
4. Medium file.
5. Two 1-1/2" (38 mm) adjustable pliers.
6. #2 Phillips screwdriver.
7. Fiberglass resin & catalyst, (marine grade) - at least 2 oz (50 cc).
   Such as Tap Plastics Marine Vinyl Ester Resin with MEKP Catalyst.
   Note: Use liquid resin, instead of paste type, due to better penetration.
8. Mixing cup – 4 oz (100 cc).
9. Disposable brush.
10. Strain Relief Assembly 124903-1, (one per cable).

**4.0 Responsibilities.** It is the responsibility of the installer to observe all standard safety precautions, including eye, slip, and chemical protection when performing this procedure.

### *4.1 Procedure.*

Remove the standard cable pass through assembly 130818-1*
* N/A for 193 cm (76-inch) nominal size radomes. Refer to Fig 1, then use #2 Phillips screwdriver to remove 4 ea. attachment screws.

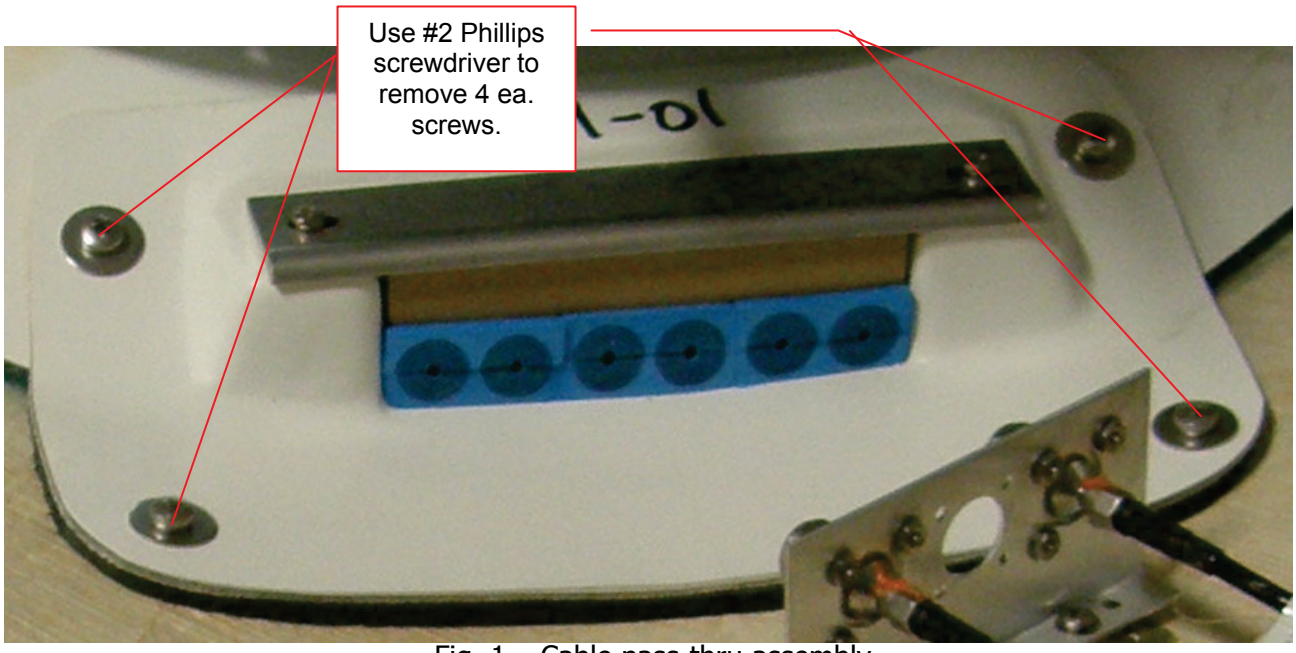



Fig. 1 – Cable pass-thru assembly

### *4.2 Making the holes*

PLANNING: Space has been allowed for up to 5 ea. strain reliefs, but, install only as many as needed. (Typically only 2-3 for TX/RX systems). Refer to Fig 2 then plan which hole positions to use.
For 76-inch radomes lowest holes may be approx 1.5 inches from inside wall corner with floor (ref drawing 129416).
**Note:** The hole center-to-center distance given is the MINIMUM.

Follow good engineering practice and provide the largest spacing possible between holes as follows:

1 Hole pattern - "A".
2 Hole pattern - "B", "C".
3 Hole pattern - "A", "B", "C", ("A", "D", "E" PERMITTED).
4 Hole pattern - "B", "C", "D", "E".
5 Hole pattern - "A", "B", "C", "D", "E".

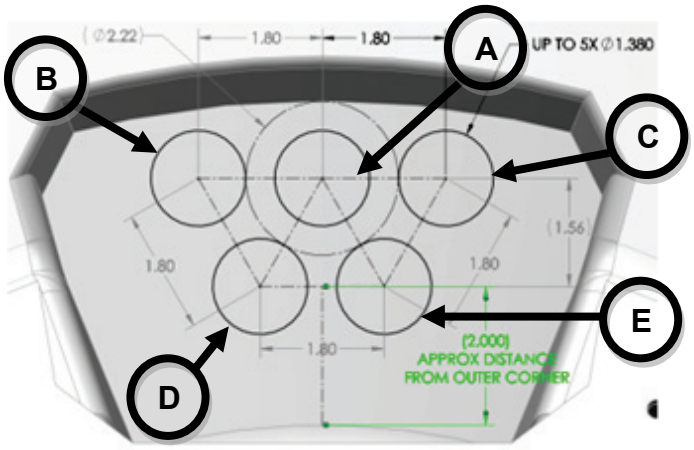



**Fig. 2 – Planning**
Measure in place or use template drawing 132234

Fig. 3 – (Up to) 5-Hole Pattern

### *4.3 Measure, mark and drill pilot holes*

**CAUTION:** The hole locations cannot be determined accurately from outside of the radome.
Using full scale drawing 132234, provided in the strain relief kit, measure mark and drill pilot holes from the inside out, and using only light pressure, use the small drill bit, (~1/8" dia) to make a pilot hole through each planned location.

### *4.4 Use the hole saw from the outside with light pressure.*

**CAUTION:** Using the hole saw from the inside is likely to damage the Gel Coat.

**CAUTION:** Heavy pressure on the hole saw from the inside is likely to damage the Gel Coat and splinter the fiberglass.

Working from the outside, use a 1-3/8" hole saw to make the holes for the planned strain reliefs.

### *4.5 After holes are drilled CAREFULLY use a file to clean the hole edges.*

### *4.6 Test fit the strain reliefs in each location, then, make adjustments as necessary.*

### *4.7 Sealing the hole edges.*

**CAUTION**: Cut edges can allow water and/or ice ingress and weaken the fiberglass laminate or structural foam. It is essential to seal all cut edges thoroughly with fiberglass resin to preserve the radome's structural strength.

**CAUTION:** Fiberglass paste or RTV silicone sealant will not wick into and seal the fiberglass strands as well as fiberglass resin, ONLY use fiberglass resin (such as TAP PLASTICS MARINE VINYL ESTER, or equivalent) for sealing the cut edges.

Follow the manufacturer's instructions to mix a small amount of fiberglass resin and catalyst, then working quickly, use a disposable brush to apply mixed fiberglass resin to the hole edges, both inside and out.

Allow the fiberglass resin to set per resin manufacturer's instructions.

Note: Like all chemical reactions, set time will be temperature/humidity dependent.

### *4.8 Refer to strain relief assembly drawing 124903*

Being careful not to damage either the radome or the strain relief threads, use adjustable pliers to install strain reliefs.

Fig. 4 – Outside view.

Fig. 5 – Outside view.

### *4.9 Rotate General Assembly (G.A.)*

Once cables have been installed, rotate General Assembly (G.A.), to ensure cables are routed properly and do not interfere with azimuth rotation.

Fig. 6 – Inside view.

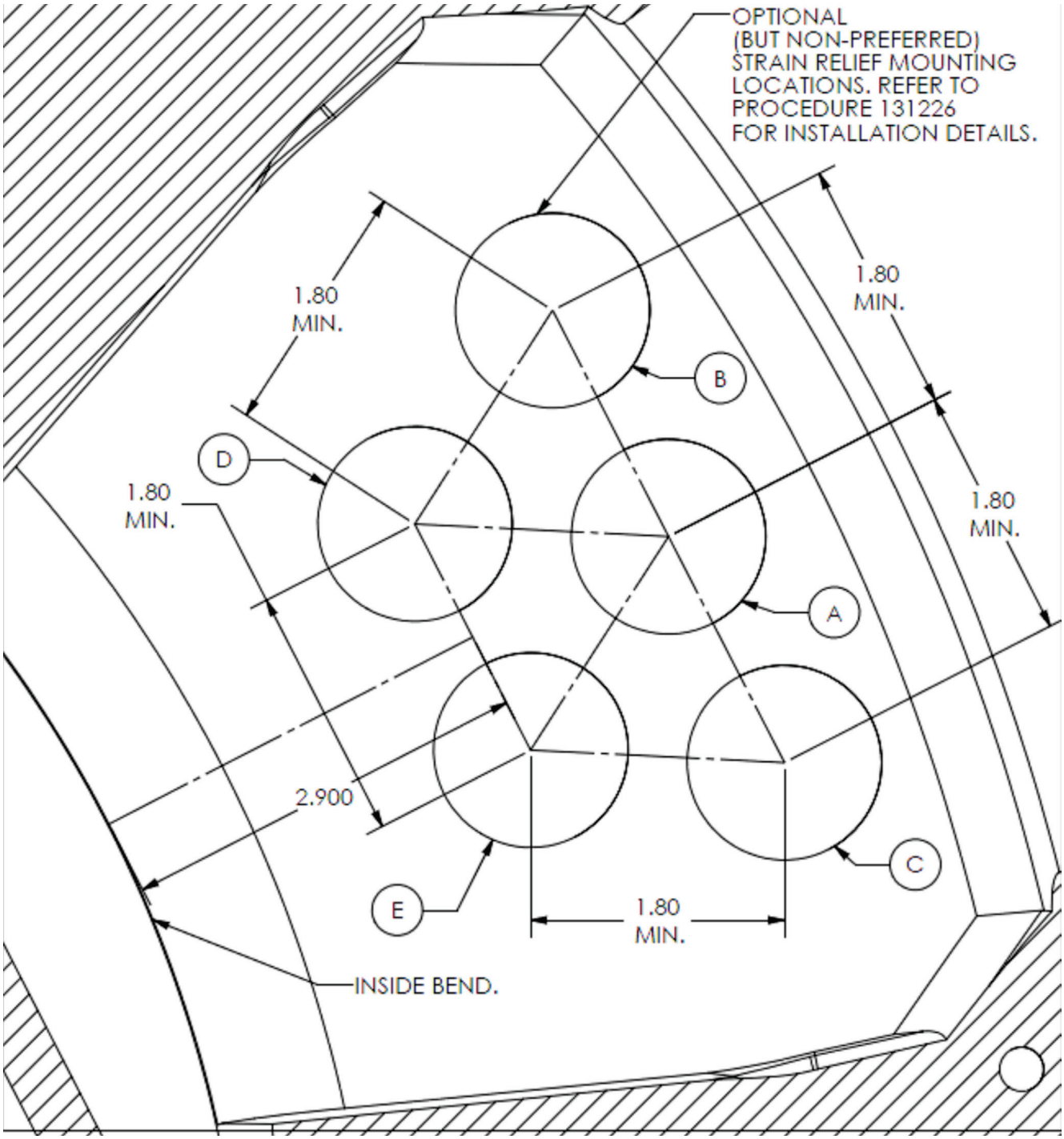
## 5.0 Records. N/A.

## 6.0 Training. N/A

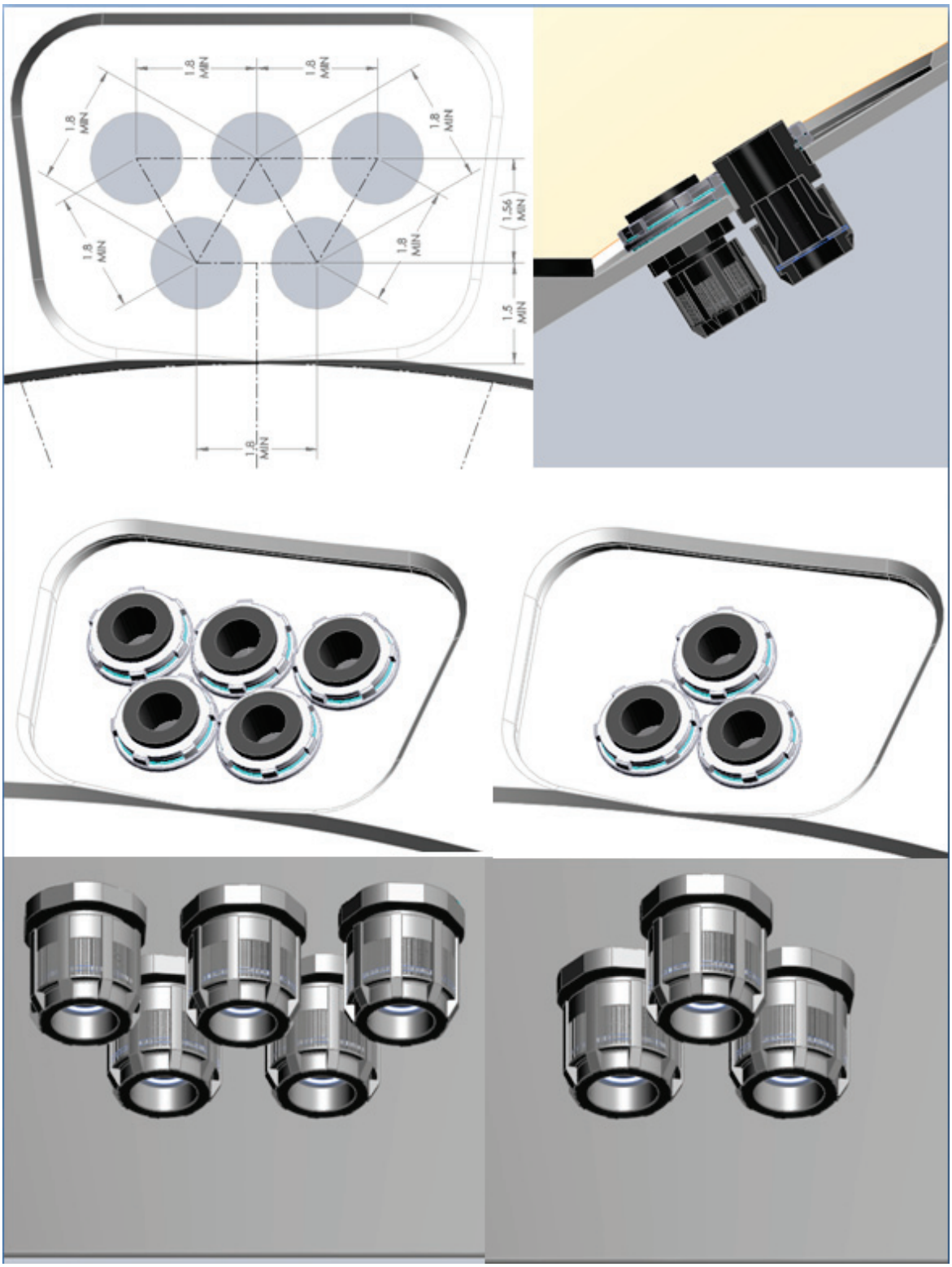
## 7.0 References.

Strain relief assembly drawing (P/N: 124903)
Template drawing (P/N 132234)

## 8.0 Strain relief positioning for 80-180 cm (34-66 in) smooth based radomes, (May use Sea Tel drawing 132234 as template.)



**9.0 Strain relief positioning for 193 cm (76-inch) radomes.**
**(May use Sea Tel drawing 132234 as template.)**



SINGLE LEVEL MFG BILL OF MATERIAL

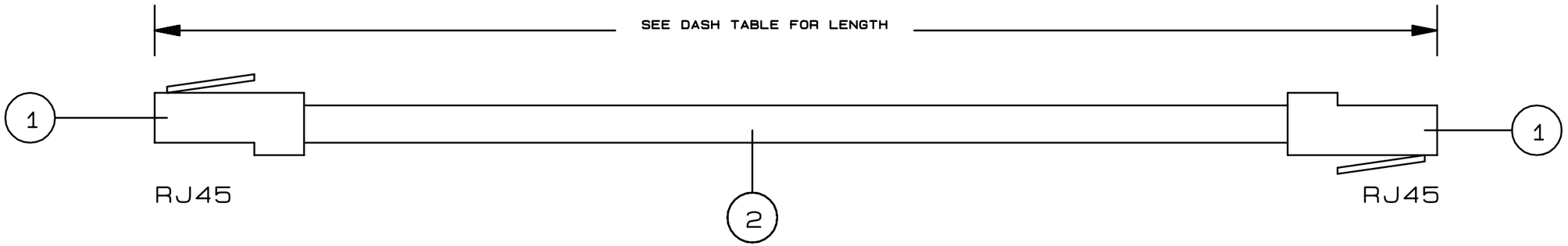
| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 2 EA | 118169-4 | A2 | CONNECTOR, MODULAR PLUG, RJ45 | |
| 2 | 60 IN | 119678 | A | CABLE, FLAT MODULAR LINE CORD | |

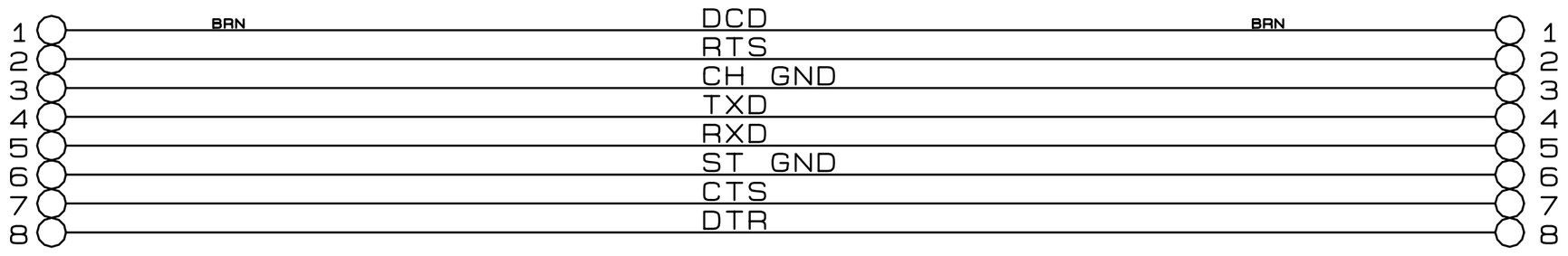
Sea Tel
COBHAM

CABLE ASS'Y, RJ-45 SERIAL, 60 IN.

| PROD FAMILY | EFF. DATE | SHT | DRAWING NUMBER | REV |
|---|---|---|---|---|
| COMMON | 5/24/2012 | 1 OF 1 | 119478-5 | D |

| REV. | ECO # | DATE | DESCRIPTION | BY: |
|---|---|---|---|---|
| A | | 05/14/01 | INITIAL RELEASE | DD |
| B | | 04/29/01 | ADDED MFG. & VENDOR COLUMN | MSF |
| C | 3577 | 6-11-02 | DASH -3 ADDED | MSF |
| C1 | N/A | 12-4-02 | WRONG LM REMOVED FROM DWG | MSF |
| C2 | N/A | 2-5-03 | -4 ADDED | MSF |
| C3 | 5804 | 9-11-07 | -5 ADED | MSF |
| D | 6987 | 12-23-09 | ADDED NOTES & DASH -6. | MSF |




NOTES:

1. IDENTIFY PER SEA TEL SPEC. 122930 APP.D.
2. SEE DASH TABLE FOR CABLE LENGTH.

| DASH NO. | DESCRIPTION | CABLE LENGTH |
|---|---|---|
| -1 | EPIPE TO PDM INTERFACE BD. | 6 INCHES |
| -2 | EPIPE TO PDM INTERFACE BD. | 8 INCHES |
| -3 | EPIPE TO PDM INTERFACE BD. | 4 INCHES |
| -4 | EPIPE TO PDM INTERFACE BD. | 7 INCHES |
| -5 | TMS TO MODEM | 60 INCHES |
| -6 | DAC TO iDIRECT MODEM | 120 INCHES |

REFERENCE:

118203 CABLE ASSY, MODULAR CORD
117979 CONTROL CABLE, REMOTE A/C

Sea Tel, Inc.
CONCORD, CA

| | | |
|---|---|---|
| SCALE: | APPROVED BY: | DRAWN BY: DD |
| DATE: 9-28-01 | | DWG SIZE: |

TITLE: CABLE ASSEMBLY, RJ-45 SERIAL

| MODEL: | | DRAWING NUMBER | REV. |
|---|---|---|---|
| MCM-8/MCM-3 | SHEET 1 OF 1 | 119478 | D |

SINGLE LEVEL MFG BILL OF MATERIAL

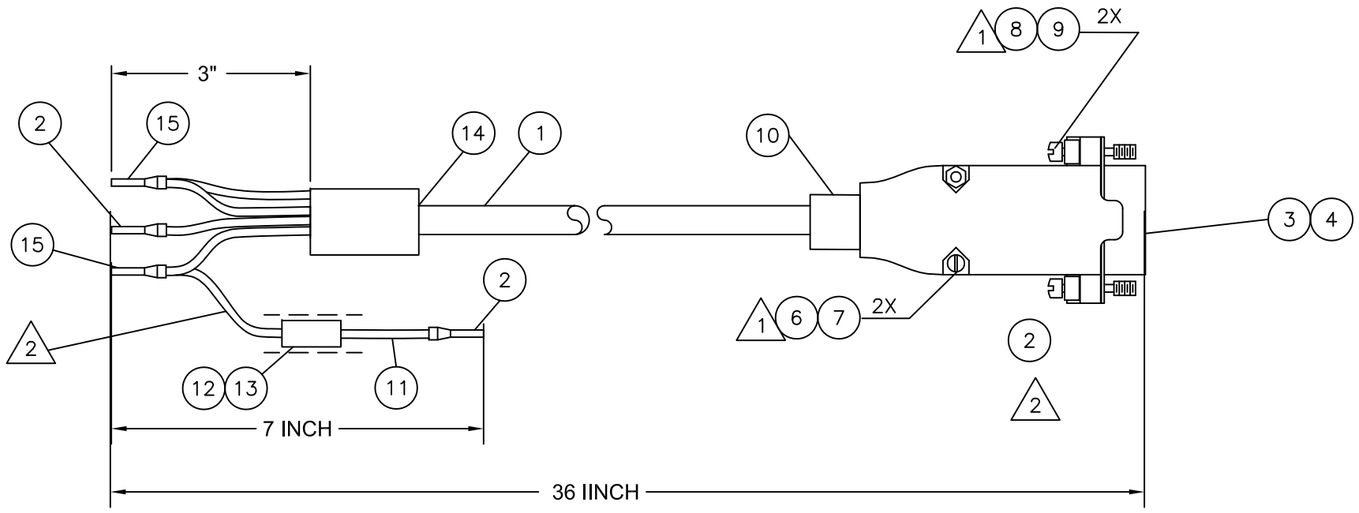
| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 37 IN | 117950-5 | A | CABLE, SHIELD CONTROL 9535 | |
| 2 | 2 EA | 121899-24 | C | WIRE PIN TERMINAL, CRIMP, 24 AWG, LT | |
| 3 | 3 EA | 112267-13 | | SOCKET, SNAP N CRIMP, DB, 24-20 AWG | |
| 4 | 1 EA | 110935-38 | K1 | CONNECTOR, D-SUB, DA-15S | |
| 5 | 1 EA | 112570-12 | G | BACKSHELL, D-SUB, NICKEL PLATED, DA, | |
| 6 | 2 EA | 114593-105 | | SCREW, SOCKET HD, 4-40 x 7/16, S.S. | |
| 7 | 2 EA | 119961-005 | | NUT, HEX, SMALL PATTERN, 4-40, S.S. | |
| 8 | 2 EA | 118128-1 | | SCREW, CAPTIVE PANEL | |
| 9 | 2 EA | 114581-005 | | WASHER, LOCK, #4, S.S. | |
| 10 | 1 EA | 119748-1 | A1 | CABLE GROMMET, PDM INTERFACE, 0.20 ID | |
| 11 | 8 IN | 113343-084 | C | WIRE, 24G, COPPER STRAND, YEL, UL1061 | |
| 12 | 1 EA | 109089-89 | | RESISTOR, 1/4 W, 5%, 10K, T-H, CARBON | |
| 13 | 2 IN | 120117-040 | | HEAT SHRINK, 1/8 DIA, BLK, SUMITUBE B | |
| 14 | 1 IN | 120117-060 | | HEAT SHRINK, 1/4 DIA, BLK, SUMITUBE B | |
| 15 | 2 EA | 121899-20 | C | WIRE PIN TERMINAL, CRIMP, 20 AWG, WHT | |

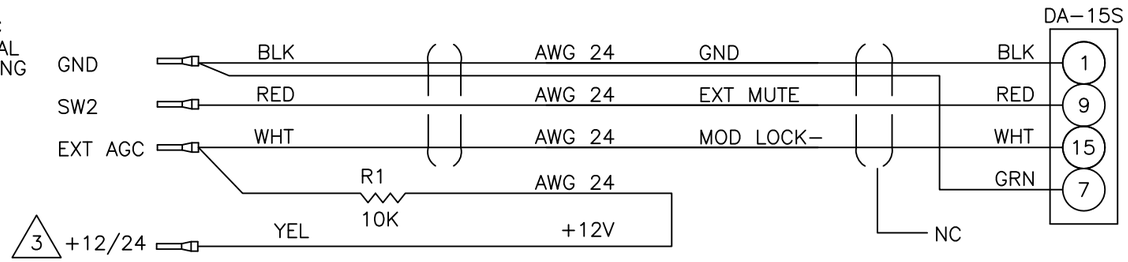
Sea Tel
COBHAM

HARNESS ASS'Y, COMTECH MODEM INTERFACE

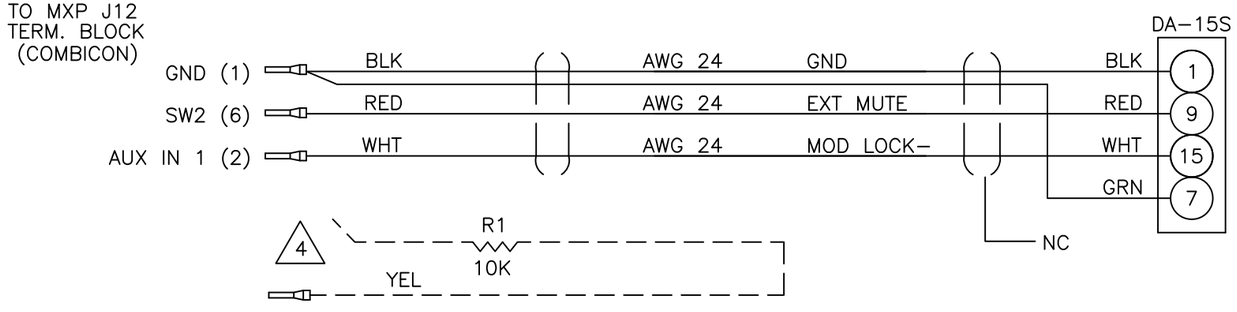
| PROD FAMILY | EFF. DATE | SHT | DRAWING NUMBER | REV |
|---|---|---|---|---|
| COMMON | 5/24/2012 | 1 OF 1 | 126877 | C1 |

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| C | 9365 | 2-24-12 | CHG. QTY. OF CRIMP PINS ON THE BOM TO REFLECT ACTUAL USAGE. CHG. THE BACKSHELL GROMMET & THE HEATSHRINK TO A SMALLER DIAMETER. | MSF |
| C1 | N/A | 3/7/12 | ADD MXP SCHEMATIC CONNECTION INFORMATION AND NOTE 4. | RML |




DAC – SCHEMATIC REFERENCE




MXP – SCHEMATIC REFERENCE

NOTES:

1. DISCARD BACKSHELL. HARDWARE AND REPLACE WITH STAINLESS STEEL HARDWARE INDICATED.
2. CRIMP ONE LEAD OF R1 IN WIRE TERMINATOR ALONG WITH WHT WIRE SOLDER YEL WIRE TO OTHER LEAD OF R1. COVER WITH HS TUBE ITEM 13.
3. FOR DUAL PCB TMS ASS'Y, CONNECT YEL WIRE TO 12/24 TERMINAL. ON 9 PIN TMS PCB. FOR SINGLE PCB TMS ASS'Y, INSTALL JP4 TO ENABLE PULL–UP ON 'EXT AGC'. REMOVE YEL WIRE AND R1.
4. FOR MXP CONNECTION, REMOVE AND DISCARD YEL WIRE AND R1.
5. IDENTIFY PER SEA TEL. SPEC. 122930 APP. D.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
<48" = ± 1"
<15' = ± 2"
<100' = ± 4"
>100' = ± 6"
INTERPRET TOLERANCING PER ASME Y14.5M - 1994

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DRAWN BY: PGB
DRAWN DATE: 7-25-07
APPROVED BY:
APPROVED DATE:

Sea Tel COBHAM
Tel. 925-798-7979 Fax. 925-798-7986

TITLE: HARNESS ASS'Y, COMTECH MODEM INTERFACE

| SIZE | SCALE: | DRAWING NUMBER | REV |
|---|---|---|---|
| B | NONE | 126877 | C1 |

FIRST USED: SHEET NUMBER 1 OF 1

DOCUMENT No. 123924-2 REV. A

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 112657 | E | MACHINING, TERMINAL MOUNTING STRIP | |
| 2 | 1 EA | 126865-2 | G | PCB ASS'Y, TERMINAL MOUNTING STRIP, 5 | |
| 3 | 1 EA | 112936-36 | D1 | CABLE ASS'Y, D-SUB, 25 PIN, 36 IN | |
| 5 | 1 EA | 116669-36 | B1 | CABLE ASS'Y, D-SUB, 9-PIN, 36 IN. | |
| 7 | 2 EA | 121228-3072 | | STANDOFF, HEX, F/F, 6-32 X .25 OD X . | |
| 9 | 2 EA | 114588-146 | | SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S. | |
| 11 | 8 EA | 114588-107 | | SCREW, PAN HD, PHIL, 4-40 x 5/16, S.S | |
| 19 | 2 EA | 114588-144 | | SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S. | |
| 29 | 1 EA | 119478-5 | D | CABLE ASS'Y, RJ-45 SERIAL, 60 IN. | |
| 30 | 1 EA | 126877 | C1 | HARNESS ASS'Y, COMTECH MODEM INTERFAC | |

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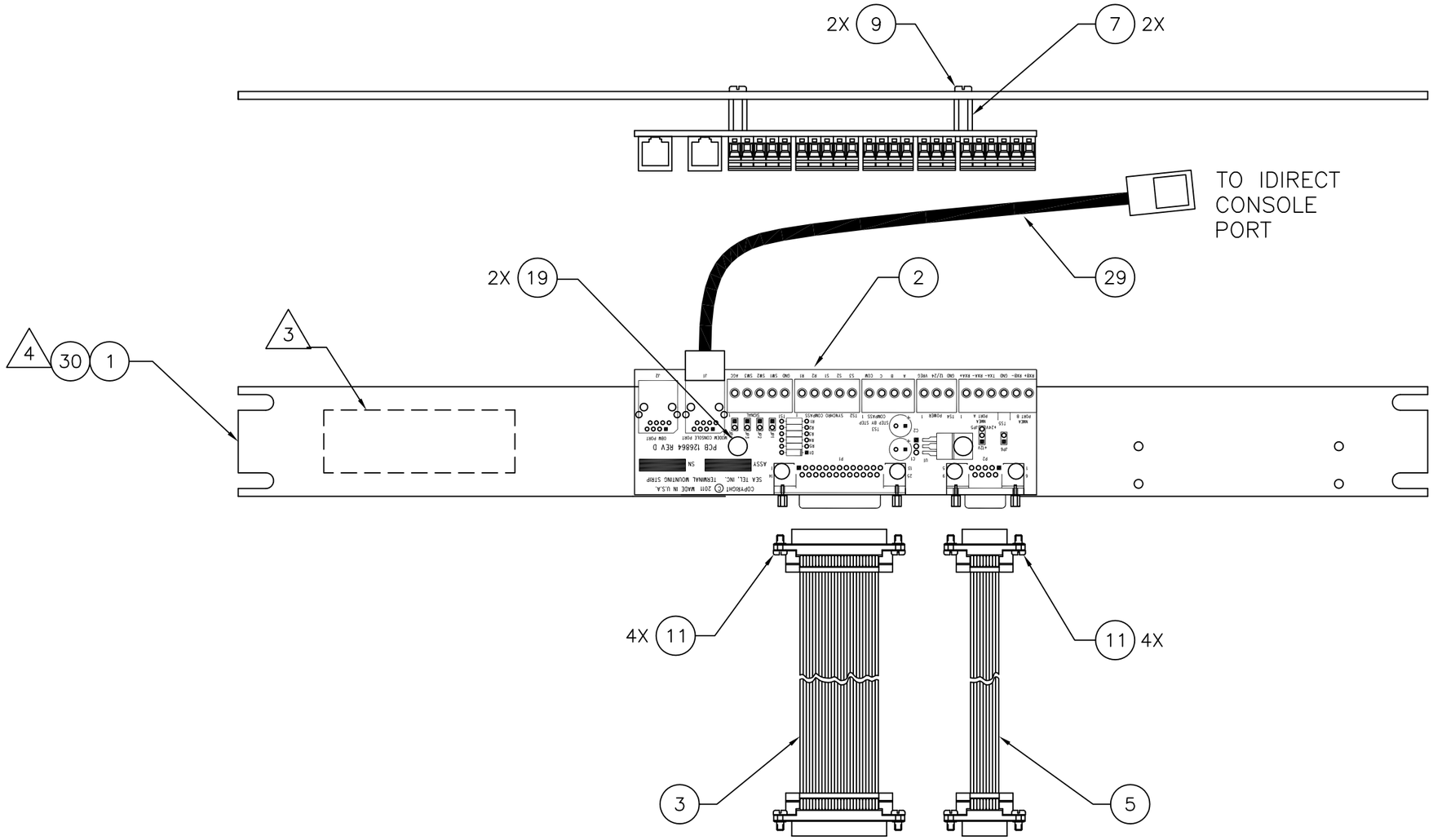
ASSEMBLY, TERMINAL MOUNTING STRIP

| PROD FAMILY | EFF. DATE | SHT | DRAWING NUMBER | REV |
|---|---|---|---|---|
| COMMON | 5/24/2012 | 1 OF 1 | 121628-4 | R |




# -4 SHOWN

| SIZE | SCALE: | DRAWING NUMBER: | REV: |
|---|---|---|---|
| B | 1/2 | 121628 | R |
| | | SHEET NUMBER: 3 of 4 | |

DOCUMENT NO. 124225-4_A

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 112657 | E | MACHINING, TERMINAL MOUNTING STRIP | |
| 2 | 1 EA | 126865-2 | G | PCB ASS'Y, TERMINAL MOUNTING STRIP, 5 | |
| 3 | 1 EA | 112936-36 | D1 | CABLE ASS'Y, D-SUB, 25 PIN, 36 IN | |
| 5 | 1 EA | 116669-36 | B1 | CABLE ASS'Y, D-SUB, 9-PIN, 36 IN. | |
| 7 | 2 EA | 121228-3072 | | STANDOFF, HEX, F/F, 6-32 X .25 OD X . | |
| 9 | 2 EA | 114588-146 | | SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S. | |
| 11 | 8 EA | 114588-107 | | SCREW, PAN HD, PHIL, 4-40 x 5/16, S.S | |
| 19 | 2 EA | 114588-144 | | SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S. | |
| 29 | 1 EA | 126877 | C1 | HARNESS ASS'Y, COMTECH MODEM INTERFAC | |

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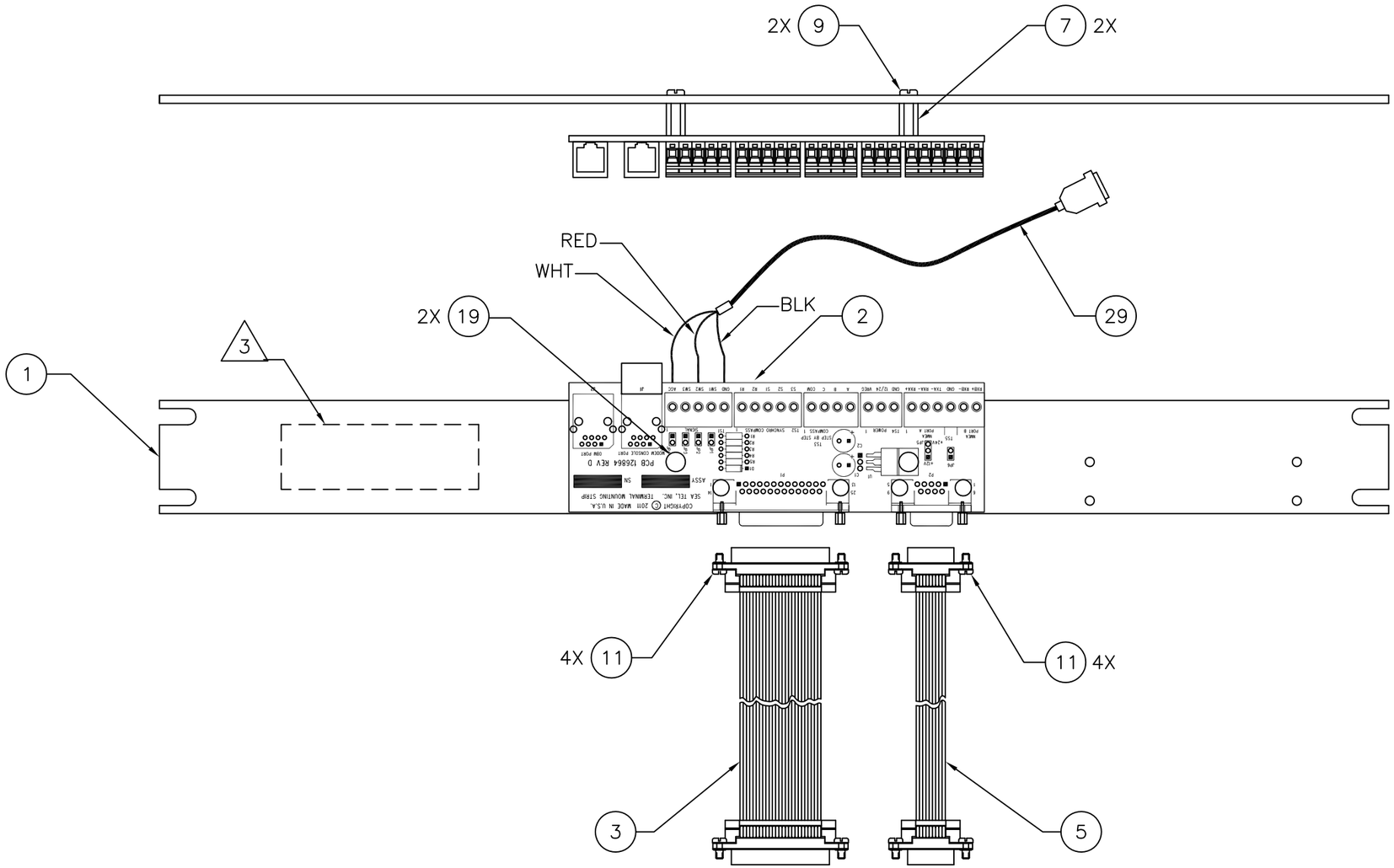
ASSEMBLY, TERMINAL MOUNTING STRIP

| PROD FAMILY | EFF. DATE | SHT | DRAWING NUMBER | REV |
|---|---|---|---|---|
| COMMON | 5/24/2012 | 1 OF 1 | 121628-5 | R |




# -5 SHOWN

| SIZE | SCALE: | DRAWING NUMBER: | REV: |
|---|---|---|---|
| B | 1/2 | 121628 | R |
| | | SHEET NUMBER: 4 of 4 | |

DOCUMENT NO. 124225-4_A

SINGLE LEVEL MFG BILL OF MATERIAL

| FIND | QTY | PART NO | REV | DESCRIPTION | REFERENCE DESIGNATOR |
|---|---|---|---|---|---|
| 1 | 1 EA | 116880 | G | PANEL MACHINING, RACK, BASE MUX | |
| 2 | 1 EA | 129613-2 | E1 | MODEM ASS'Y, 400MHZ FSK, 3 CH, BDE, R | |
| 3 | 1 EA | 116388 | D | BRACKET, CONNECTOR | |
| 4 | 1 EA | 115492-1 | C8 | ADAPTER, N(F)-SMA(F), W/FLANGE | |
| 5 | 8 EA | 114588-107 | | SCREW, PAN HD, PHIL, 4-40 x 5/16, S.S | |
| 6 | 8 EA | 114583-005 | | NUT, HEX, 4-40, S.S. | |
| 7 | 2 EA | 114588-144 | | SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S. | |
| 8 | 6 EA | 114580-007 | | WASHER, FLAT, #6, S.S. | |
| 9 | 1 EA | 110567-19 | C1 | ADAPTER, N(F)-N(F), STRAIGHT, FLANGE | |
| 11 | 1 EA | 113303-10 | V | CABLE ASS'Y, SMA 90 - SMA (M), 9 IN | |
| 12 | 8 EA | 114580-005 | | WASHER, FLAT, #4, S.S. | |
| 13 | 4 EA | 114588-145 | | SCREW, PAN HD, PHIL, 6-32 x 5/16, S.S | |

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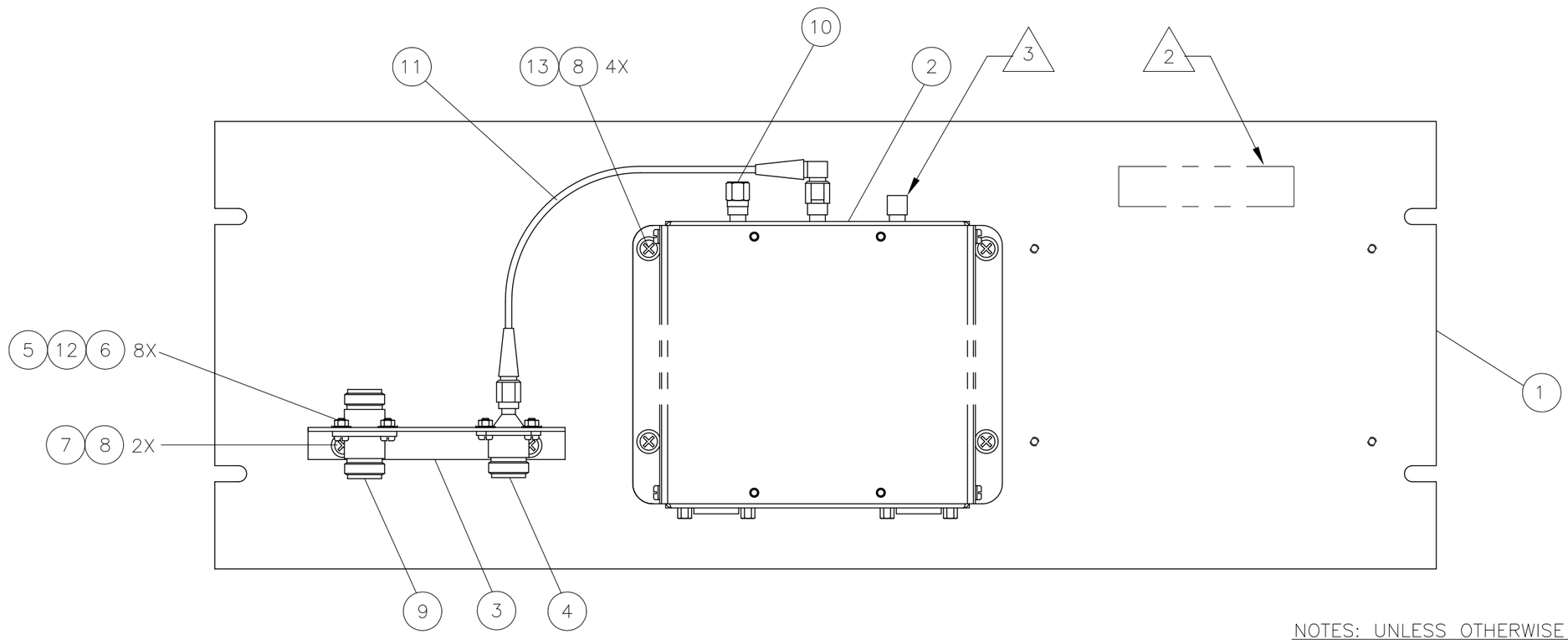
BASE MUX RACK PANEL ASS'Y, 400MHZ, RS-232

| PROD FAMILY | EFF. DATE | SHT | DRAWING NUMBER | REV |
|---|---|---|---|---|
| COMMON | 5/24/2012 | 1 OF 1 | 129710-1 | B2 |

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| REV | ECO# | DATE | DESCRIPTION | BY |
| A1 | N/A | 8-4-09 | ADDED -2. | K.D.H. |
| B | 7040 | 1-12-10 | ADDED ITEM 10, NOTE 4 | K.D.H. |
| B1 | 8180 | 2-14-11 | UPDATE NOTES. | SL |
| B2 | N/A | 3-21-11 | ADDED -S1 & -S2 | K.D.H. |




NOTES: UNLESS OTHERWISE SPECIFIED :

1. MANUFACTURE PER SEA TEL SPEC 122298.
2. IDENTIFY PER SEA TEL SPEC. 122930(APPENDIX D) APPROXIMATELY WHERE SHOWN.
3. DASH 2 (4 CHANNEL) ONLY.
4. DASH 2, WHEN ITEM 2 IS USED IN A SYSTEM THAT USES THE L-BAND PORT, BAG & SHIP ITEM 10.

| DASH | DESCRIPTION |
|---|---|
| -1 | 3 CHANNEL |
| -2 | 4 CHANNEL |
| -S1 | 3 CHANNEL, SPARES KIT |
| -S2 | 4 CHANNEL, SPARES KIT |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
X.X = ±.050
X.XX = ±.020
X.XXX = ±.005
ANGLES: ±.5°

INTERPRET TOLERANCING PER ASME Y14.5M - 1994

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DESIGNER/ENGINEER:

WEIGHT:

MATERIAL:

FINISH: N/A

SURFACE ROUGHNESS: N/A

3rd ANGLE PROJECTION

DRAWN BY: KRB

DRAWN DATE: 01/23/09

APPROVED BY:

APPROVED DATE:

Sea Tel
COBHAM
Tel. 925-798-7979 Fax. 925-798-7986

TITLE: BASE MUX RACK PANEL ASS'Y, 400 MHZ, RS-232

SIZE: B | SCALE: 1/2

DRAWING NUMBER: 129710 | REV: B2

FIRST USED: XX09

SHEET NUMBER 1 OF 1

DOCUMENT NO. 124225-4_A